EDGAR J. BUTTENHEIM, President | THEODORE R. KENDALL, Editor | L. V. WEYAND, Associate Editor | P. C. FORD, Secretary | HERBERT K. SAXE, Treasurer | MYRON MACLEOD, Advertising Manager

Vol. XVII
No. 4

# Contractors and Engineers Monthly

October,
1928

Published Monthly at 443 Fourth Ave., New York, by Buttenheim-Dix Publishing Corporation. *Branch Offices*: Tribune Tower, Chicago, Tom Dix, Vice-president: 410 Hanna Building, Cleveland, George Conover, Manager; 155 Montgomery St., San Francisco, Roger A. Johnstone, Manager.

## TABLE OF CONTENTS

**ACCOUNTING**
Contractors' Accounts ..... 213

**CONCRETE CURING**
New Method of Sprinkling Concrete for Curing..... 232

**CONCRETE PIPE LINE**
Experience in Construction of a Gunited Steel and Centrifugally Cast Concrete Pipe Line..... 203

**DAM CONSTRUCTION**
Concrete and Material Control at Coolidge Dam..... 222

**EXCAVATION**
How Many Hauling Units to Serve the Shovel?..... 221
Sheathing and Shoring Excavations for Philadelphia College Building ..... 226
An Efficient Shovel Operator an Important Factor..... 232
Large Fill Handled by Slackline Cableway..... 233

**EQUIPMENT AND MATERIALS**

CONCRETE MACHINERY
A New Concrete Cart ..... 256
A New Water Regulator ..... 260

CONVEYORS
A Portable Belt Conveyor with Shaker Screen... 260

DIRT MOVERS
Light Draft Crawler Wagon for Earth Moving..... 268
Automatic-Gravity Dump Body for Ford Chassis... 270

HOISTS
A 2-Speed Slackline Cable-way Hoist..... 254

INDUSTRIAL RAILWAY EQUIPMENT
Inequalities of Track Minimized ..... 262

MISCELLANEOUS
An Earth Boring Machine ..... 254
Insulated and Water-proofed Roofs ..... 262
Jacks for Pushing Pipe Underground ..... 264
A Cable Testing Machine for the New Hudson River Bridge ..... 266
New Equipment for Sterilizing Construction Camp Drinking Water ..... 268

PNEUMATIC MACHINERY
An Economical Air Compressor..... 254
Riveting Hammers ..... 258
A 360-Foot Compressor ..... 258

PORTABLE LIGHTING UNIT
Flood Light Attachment ..... 256

PUMPS
A Vertical Dewatering, Pump Unit..... 253

ROAD MACHINERY
Patent Issued on Automatic Pivotal Axle for Graders ..... 256
A One-Man Concrete Highway Surfacer..... 270

TRACTORS
A New, Small Model Tractor ..... 266

WELDERS
Improved Acetylene Generators ..... 264

**ITEMS OF INTEREST**
Variations in Mixing Time on Concrete Highway Projects ..... 217
Large Highway Project Under Way in New Mexico... 225
Hauling with Teams and Wagons ..... 225
The Five Ages of Construction as Seen by the Public. 227
Elements of Highway Engineering..... 230
Foundations for Chicago's Merchandise Mart to Have Ten Miles of Caissons ..... 232
Valuable Steel Construction Literature Available for Contractors ..... 238
New Skyscrapers in Philadelphia Use Concrete Units. 238
Cutting 12 x 12 Fir Piles 20 Feet Under Water..... 238
Contracts Awarded for Toll Bridges ..... 242
Construction Industry News ..... 252
Six State Projects Let in New Mexico..... 264
Well Point Drainage Used on Large New York Excavation ..... 268
Help for Contractors ..... 272

**LAW AND LITIGATION**
Legal Points for Contractors ..... 248

**ROAD CONSTRUCTION**
An 11-Mile Indiana Concrete Road Job..... 218
A Record Pour of Concrete on a Los Angeles Subdivision Road ..... 227
Steady Plugging Overcame Weather Handicaps..... 228
A 1.5-Mile New Jersey State Aid Road Job..... 231
7.89 Miles of Pavement Built in 96 Working Days..... 234
Truck Speed on Grading Operations Is Governed by Road Conditions ..... 242

**SAFETY IN CONSTRUCTION**
"Safety First" Is a Necessity, Not Merely a Slogan.... 233
Safety in Steel Erection ..... 239

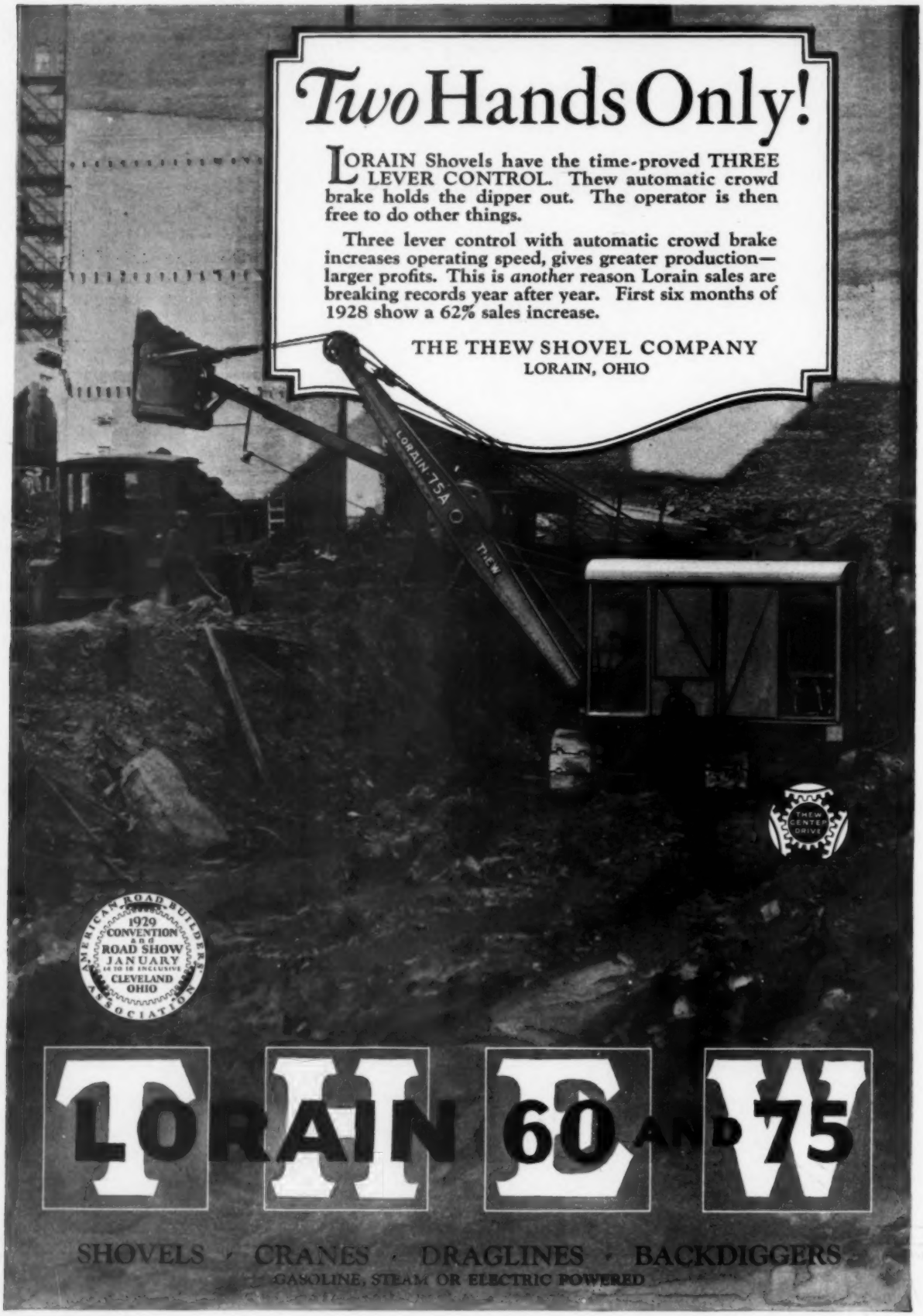
**SAND AND GRAVEL**
The Otay Rock and Sand Plant at San Diego, Calif.... 235

**WATER-WORKS CONSTRUCTION**
Experience in Construction of a Gunited Steel and Centrifugally Cast Concrete Pipe Line ..... 203

**WHO'S WHO IN CONSTRUCTION**
Reports from Active Contractors ..... 244

**WINTER CONSTRUCTION**
Building Construction Throughout the Year..... 221
Winter Construction Pays ..... 238

***For Directory of Local Distributors of Contractors' Equipment, See Pages 103 to 124***


Two Hands Only!
LORAIN Shovels have the time-proved THREE LEVER CONTROL. Thew automatic crowd brake holds the dipper out. The operator is then free to do other things.
Three lever control with automatic crowd brake increases operating speed, gives greater production—larger profits. This is *another* reason Lorain sales are breaking records year after year. First six months of 1928 show a 62% sales increase.
THE THEW SHOVEL COMPANY
LORAIN, OHIO
LORAIN 75A
THEW
THEW CENTER DRIVE
AMERICAN ROAD BUILDERS' ASSOCIATION
1929 CONVENTION AND ROAD SHOW JANUARY 14 TO 18 INCLUSIVE CLEVELAND OHIO
THEW
LORAIN 60 AND 75
SHOVELS · CRANES · DRAGLINES · BACKDIGGERS
GASOLINE, STEAM OR ELECTRIC POWERED



Please mention the CONTRACTORS AND ENGINEERS MONTHLY—it helps.

Vol. XVII
No. 4

Contractors and Engineers Monthly

October,
1928

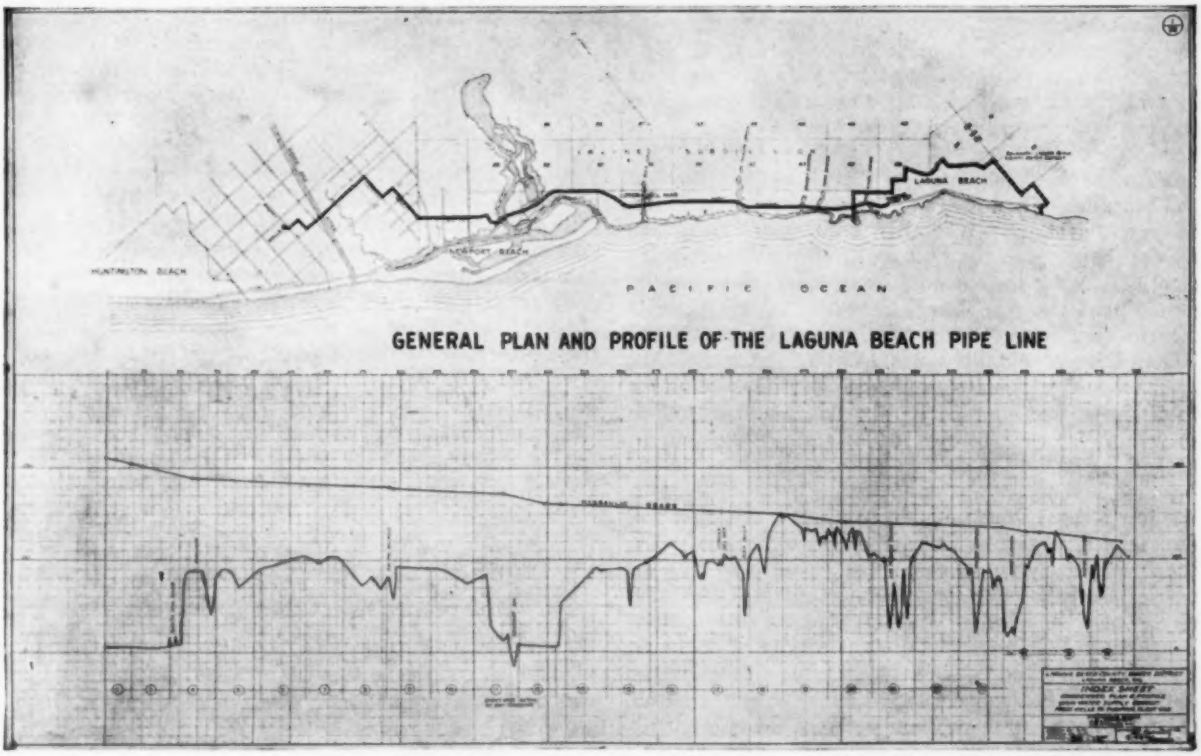
# Experience in Construction of a Gunited Steel and Centrifugally Cast Concrete Pipe Line

By E. A. Rowe

*Engineering Offices, J. B. Lippincott, Los Angeles, Calif.*

THE Laguna Beach pipe line has now been in operation for over one year. While this period of time is not adequate to reach definite conclusions as to the merits of the types of pipe used, a recent examination of the entire line made by the engineers in charge of the work showed it to be in excellent condition and indicated that their expectations at the time the line was installed would be justified as time went on. Inasmuch as this pipe line was constructed of pipes heretofore unused in California, it aroused the interest of many water-works men and during construction was visited by many members of the engineering profession.

Laguna Beach is located on the coast of Orange County, Calif., about 35 miles south of Los Angeles harbor. In 1926 it had a permanent population of approximately 1,500. During the summer season the population increases to more than 6,000. The water-supply for this community prior to the installation of the new works was obtained from wells located in the small



canyons back of the town. The water from these wells was poor in quality and scant in quantity. As a result of the past group of dry years in Southern California, this source of supply practically failed, and most of the water consumed in the district was brought in, in bottles or tank-wagon.

### WATER DISTRICT FORMED

To relieve the situation, a water district was formed under the County Water District Act, and the Engineering Offices of J. B. Lippincott were employed to prepare plans and estimates for bringing in a new water-supply and the construction of an adequate distribution system. It is interesting to know that the election for the organization of the district was unanimous. When the bond election was submitted to the voters it was also unanimous. The total area within the boundaries of the district is approximately 1,450 acres. A bond issue of $600,000 was voted for the construction of the necessary works. This represents a debt of $400 per acre for the lands of the district and at the time of the election approximately $400 per capita.

### NEW SOURCE LOCATED

Investigations showed that the only available source of water-supply was from the ground waters of the coastal plain largely replenished by the Santa Ana River. One hundred and twenty acres of water-bearing land were purchased by the district for the necessary wells. These wells are located about 13 miles northerly up the coast from Laguna Beach. To make this water available for the district, it was necessary to construct a pipe line approximately 70,000 feet in length to the westerly boundary of the district and to install pumping equipment for lifting the water from the wells about 175 feet through this pipe line.

The location and a profile of this line are shown on the accompanying map. Between Newport Bay and the city of Laguna Beach the line parallels the State Highway from Los Angeles to San Diego and passes through a strip of unusually attractive coastal lands belonging to the Irvine Company. These lands in the near future will undoubtedly be developed for residential purposes. They had no adequate water-supply immediately available. When Mr. Irvine was approached by the Directors of the District to secure the necessary right-of-way for their conduit over these lands, he suggested that the pipe line be constructed adequate in size to care for not only the Laguna Beach County Water District but his lands fronting the coast. Mr. Irvine agreed to contribute to the cost of the line on the basis of the carrying capacity allotted to him, as well as to furnish the right-of-way free of cost. As such an arrangement would result in a substantial saving to the District, a contract was entered into between the District and the Irvine Company whereby this line was built and a portion of its carrying capacity allotted to the Irvine Company. The company paid over half the cost of the entire line for approximately half the capacity. The company is to develop its own water independent of the Water District for the service of its lands. The operation and maintenance of the line is vested entirely in the Laguna Beach County Water District, the cost thereof to be prorated between the two parties.

### SELECTION OF TYPE OF CONDUIT

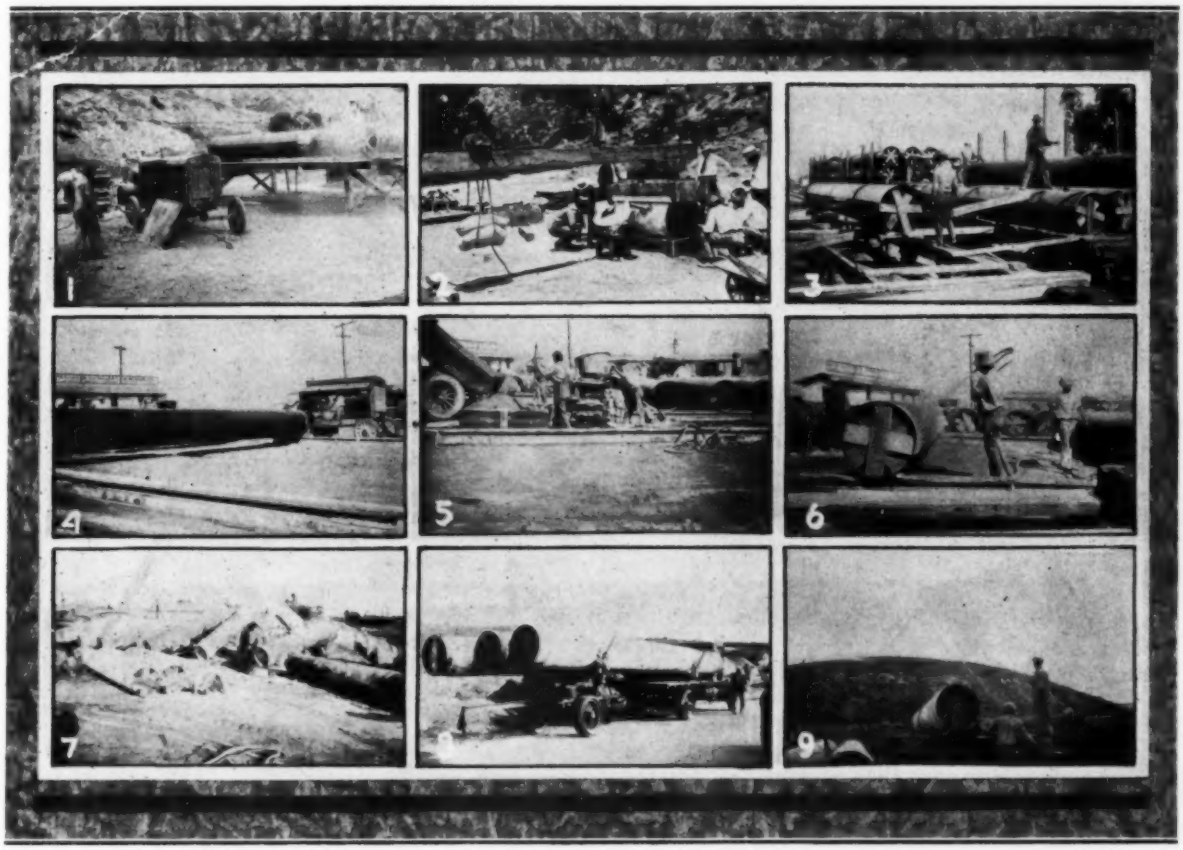
The selection of the proper type of conduit was given particular consideration. Economic studies were made for various routes, assuming its construction of practically all the various types of pipe then in use in California. These studies were made by determining the total cost of the line of various sizes and kinds of pipe for a term of years, the cost covering interest, depreciation, maintenance and operation, including pumping expenses. Consideration was given to the length of life of the various kinds of pipe and to their coefficient of friction. The line has a maximum capacity of 15 second-feet for over 75 per cent of its length, reducing to 5 second-feet at its terminus. The controlling elevation is about two-thirds of the distance from the wells, the elevation at this point being approximately 150 feet higher. That portion of the line from the wells to the high point will be a force main subject to water-hammer. From this point the water flows by gravity to a reservoir at its terminus on the westerly side of the Laguna Beach District. Air chambers are to be installed at the pumping-plants so that the maximum head on the force main including water-hammer will be in the neighborhood of 250 feet and the maximum head on the gravity line 125 feet.

The line for practically its entire length passes through sedimentary soils which experience has shown to be particularly severe in their corrosive action on steel pipe. In view of the heavy initial cost of this line, every effort was made to secure one that would have a relatively long life as well as adequate strength to withstand the pressure obtaining. The most satisfactory type of pipe to meet these requirements is undoubtedly cast iron. Our estimates showed that the cost of building this line of cast iron, however, was beyond the financial resources of the District. The two types of pipe most generally used in California for such construction are either of steel or reinforced concrete. Both types have their advantages and disadvantages. The steel pipe has adequate strength, but in these sedimentary soils has a relatively short life. Reinforced concrete pipe as manufactured up to the time of the construction of this line had a long life but was lacking in strength. Previous to this time it had not been successfully used on a large scale for heads over 125 feet. Owing to the many steep syphons existing in the gravity portion of the line, the type of joint in general use in reinforced concrete pipe was expected to give trouble. As a result of intensive investigation and experiments, the line was built of electrically welded steel pipe having a protective coating of gunite for the force main and a centrifugally spun reinforced concrete pipe for the gravity section. It is believed that the steel pipe with the gunite coating will combine the lasting qualities of the concrete pipe and the strength of the steel pipe. The centrifugally spun reinforced concrete pipe has substantially greater density than the ordinary poured pipe, and the type of joint used is believed to be superior to the methods used in joining the poured pipe.

### INVESTIGATION OF CONCRETE COVERED STEEL PIPE

In numerous localities in Southern California steel pipe which had begun to show wear was exposed and a concrete jacket poured around the pipe. While this work has resulted in an increase in its life, it has been

expensive. Mr. Lippincott and the writer had long been considering the possibility of protecting steel pipe with gunite. Investigations were made as to the feasibility of protecting the pipe in this manner and it was found that the late J. D. Schuyler, an eminent California engineer, had had the same idea some fifteen years previously. In connection with some work he was doing for the Sweetwater Water Co. in San Diego County he had had some riveted steel pipe coated with gunite and installed in their system. The soil conditions at that point are particularly severe on steel pipe. Through the cooperation of the officials of the Sweetwater Water Co. we had this line exposed and made an examination of its condition. It was built of 12-inch, 14-gage riveted steel pipe, several thousand feet in length. About 200 feet of the line had been given a protective coating of gunite, the remainder being ordinary dipped pipe. The gunite had been applied in Los Angeles and the pipe shipped by rail to San Diego, where it was installed. The coating was about ½-inch in thickness, reinforced with 1-inch mesh poultry netting. When examined, it was found that the gunite was in excellent condition, free from cracks, and showed no sign of deterioration. An opening was cut through the gunite to expose the steel to determine its condition. The steel was bright and appeared to be as good as it was the day installed. This gunite had been applied over the asphalt dip. We were informed by the officials of the Sweetwater Water Co., that the remainder of the line, which did not have the gunite coating, had depreciated to such an extent after a period of thirteen years that they found it necessary to pour a concrete jacket around it in order to avoid its immediate duplication. Mr. Covert, the engineer of the Sweetwater Water Co., states that if this concrete had not been applied, it would have been necessary to abandon the line in another two years.




*EXPERIMENTAL AND CONSTRUCTION WORK ON THE GUNITED STEEL PIPE*

1. *Guniting experimental sections of steel pipe.* 2. *Testing experimental sections of gunited pipe for external load.* 3. *Steel pipe arriving at yard at Costa Mesa.* 4. *Reinforcing in place and pipe on tracks in contractor's yard.* 5. *Delivering mixed sand and cement to the cement gun in the yard.* 6. *Guniting the pipe in the yard. Note the bracing in the interior of the pipe.* 7. *Large special angles manufactured and gunited in the yard.* 8. *Special truck and dolly used in transporting gunited steel pipe to the trench.* 9. *Unloading pipe at the trench.*

### STEEL TEST PIPE MANUFACTURED

The results of this investigation were so encouraging that we felt warranted in carrying out further experiments to determine the feasibility of this pipe for the Laguna Beach line. The Sweetwater pipe confirmed our opinion that the gunite coating could be successfully applied to the pipe before it was laid and would add substantially to its life. We had some apprehension, however, as to the durability of the gunite coating on pipes as large as 30 inches in diameter, particularly under external load and pulsations due to water-hammer. A pipe of this size made of relatively thin steel plates has a tendency to flatten and become elliptical in section when empty, rounding out under water pressure.

Through the courtesy of the Western Pipe & Steel Co. of California, sections of electrically welded steel pipe 30 inches in diameter and of varying thickness were manufactured for the district for experimental purposes. A yard was provided in Laguna Beach, and these sections of pipe were given various thicknesses of gunite coating, reinforced in various manners. The equipment and labor necessary to carry on these investigations were furnished free of charge by the Cement Gun Construction Co. of California. Mr. Vern Case, of that company, cooperated throughout the experiments with the writer and the other engineers. These experimental sections, after being thoroughly cured, were tested for external load in a machine. The tests were made to determine the deflection the pipe would stand without cracking the gunite, as well as its durability under ordinary conditions of handling, the proper thickness of steel and gunite to be used, the proper type of reinforcing and the most satisfactory mix. The results obtained from this test, while interesting and of value in determining the proper thickness of steel and gunite, were not conclusive as to the external load the pipe could stand, owing to the relatively short sections tested and the methods of loading. They showed that the thickness of the steel plates was of greater importance than the thickness of the gunite coating in order to prevent cracking. For a 30-inch line it was decided to use 3/16-inch plates with a ¾-inch coating of gunite having a mix of 1 of cement to 5 of sand. This resulted in a 1:3 mix on the pipe. The reinforcing decided upon was a galvanized, electrically welded fabric, 2 x 4-inch mesh of 14-gage wire.

As a further test, a section of 24 feet in length was gunited and buried in a trench with 6 feet of cover. The pipe was later removed and showed practically no cracking. This section was then given rather severe handling without damage to the gunite. The experiments demonstrated the importance of proper curing and the necessity of bracing the pipe in the interior to bring it to a true circle until the gunite had cured, at which time the braces could be removed and the pipe handled without damaging the protective coating. Data were also obtained upon which to base an estimate of the cost of doing this work, and it is interesting to note that the cost as actually determined over the entire job was practically as originally estimated.

### Investigation of Concrete Pipe

For the gravity portion of the line, investigations and experiments were made, through the courtesy of the Western Concrete Pipe Co., of centrifugally spun, reinforced concrete pipe. Pipe manufactured by this process had been used to some extent in the East, but to our knowledge none had been installed on the west coast. It had been extensively used in Australia and South Africa. A search was made of all available literature dealing with this pipe, and the Western Concrete Pipe Co. installed apparatus for manufacturing it under the so-called Hume process. Experiments were made at their plant under the direction of the engineers of the District to determine the proper mix, type of reinforcement, and time and rate of spinning. The experimental sections were tested under internal pressure with very satisfactory results, which resulted in specifying this type of pipe for the gravity portion of the line.

Specifications were drawn and bids received which resulted in the award of the general contract for the entire line to the H. W. Rohl Co., of San Francisco. The steel pipe was manufactured by the Steel Pipe & Tank Co., of Berkeley. The gunite coating applied by the Cement Gun Construction Co. of California, and the reinforced concrete pipe manufactured and laid by the Western Concrete Pipe Co., of Los Angeles.

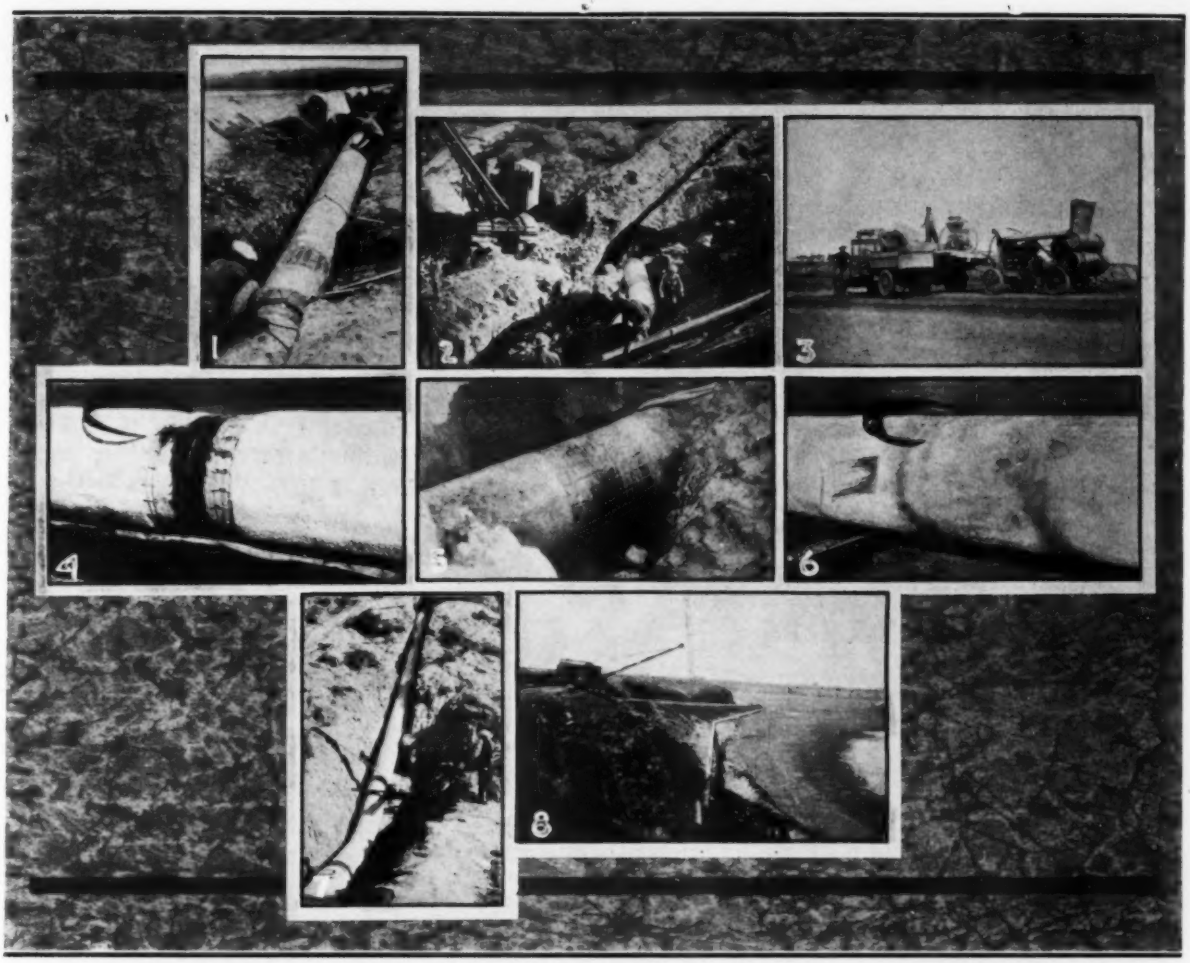
### Construction of Force Main

The steel pipe was manufactured at the factory in sections 32 feet in length. Each section was made up of two plates. The plates were rolled and the longitudinal seam was automatic electric butt welded. These two cylinders, or "cans," were joined by an automatic electric lap weld. The pipe was made of inside and outside courses, the minimum internal diameter being 30 inches. After the pipes had been welded into sections 32 feet in length, they were tested under an internal pressure of 150 pounds per square inch and all leaks or sweats repaired.

After being tested it was pre-heated and vertically dipped with petrolastic pipe dip. The ends of each section were protected so that they were not covered with dip for the last six inches. The pipe was shipped from Berkeley to a yard located at Costa Mesa, near Newport Beach, where it was unloaded and all places where the dip had been damaged were repaired. The interior bracing was then placed in the pipe to bring it to a true circle. Three sets of braces were put in each 32-foot section, one in the center and one at each end. The character of this bracing is shown in the accompanying photographs. After the bracing had been installed, the reinforcing fabric was applied to the outside of the pipe. This consisted of 14-gage galvanized electric welded fabric. The roundabout wires were 2-inch centers, and the longitudinal wires 4-inch centers. This fabric had been crimped at the factory so that as it was laid on the pipe it was uniformly held ½-inch from the exterior surface by the crimps.

The contractors had obtained a yard consisting of approximately five acres adjacent to the Southern Pacific Railroad, which paralleled one end of the property. At this yard were located the garage and machine shops of the general contractor and the central plant of the Cement Gun Co. Their plant consisted of a compressor house containing two Ingersoll-Rand permanently mounted 300-cubic-foot air-compressors directly connected to gasoline engines. In addition to the two mounted compressors, the contractor also had available two portable ones. A cement storage house was provided as well as sand bunkers. Cement and sand for the gunite work was mixed dry at a central mixing plant.

Extending from the railroad tracks to the rear of the yard were a number of wooden tracks about 31 feet center to center upon which the pipe was rolled from the cars. All of the yard work was done on these tracks, and the pipe did not leave them until the gunite had been applied and cured. As the plant was operated, pipe was continually being received at one end of the track and delivered to trucks with the gunite coating properly cured from the other end. Drains were provided under the tracks to carry off water from the curing operations. Air lines were also installed throughout the yard for delivering compressed air to the cement guns.



*FIELD WORK ON THE GUNITED STEEL PIPE OF THE LAGUNUA BEACH PIPE LINE*

*1. Laying 30-inch gunited steel pipe in trench. Welder is making a "tack" weld for hinging the pipe over the preceding section for lap welding the field joint. Note manhole for work on interior of pipe. 2. Gunited steel pipe was laid in many rough canyons such as this without damage to the coating. 3. Portable outfit used in guniting field joints. 4. Field joints welded, painted and tested, ready for gunite. 5. Field joint being gunited after reinforcing fabrics have been placed. 6. A completed field joint. 7. A completed syphon of gunite steel pipe ready for sand backfill. 8. Gunited steel pipe laid on piers over bad ground*

After the reinforcing fabric had been applied, the gunite was shot on the pipes. The mix used was one of cement to five of sand. It was found that the rebound on pipe work was considerably more than on flat work, such as buildings or canal and reservoir linings. A 1:5 mix at the gun would give 1:3 on the pipe. A total of 14.4 sacks of cement was used per cubic yard in place. It was the original intention to salvage the rebound and re-use it as sand. Under actual operation, however, the rebound was not reused. During the progress of the work an analysis was made of the materials required and percentage of rebound for one 32-foot length of pipe, of which 30 lineal feet was gunited, with the following results.

Material put in mixer:

| | |
|---|---|
| Cement | 7 cu. ft. |
| Sand | 35 cu. ft. |
| Total | 42 cu. ft. |

After mixing the volume was 38.7 cu. ft.

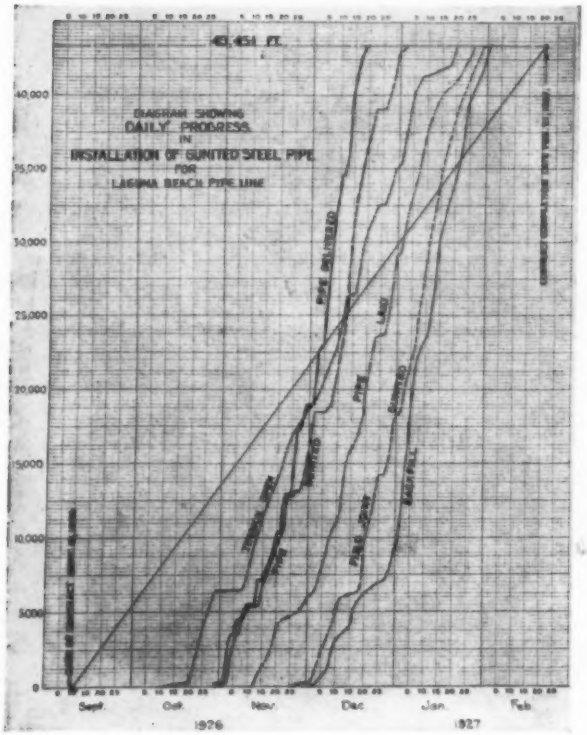
Rebound during shooting was collected on a canvas and when measured was 14.7 cubic feet. Assuming all rebound was sand, then total rebound equals 42 per cent of sand measured loose. Net material shot on above assumption:

| | |
|---|---|
| Cement | 7 cu. ft. |
| Sand | 20.3 cu. ft. |

Resulting mix on pipe = 1:3

It was found that the pipes could be rolled, if handled carefully, while the gunite was being applied, without damage. After the pipes had been coated they were rolled to the rear of the track, where they were cured. It was found to be undesirable to attempt any wetting of the gunite for the first two hours after the pipe had been coated, as the water would run down the side, dropping off the bottom, having a tendency to cause the gunite on the bottom of the pipe to slump. After this period it was covered with wet burlap. The burlap was kept wet continuously during the daylight hours as long as the pipe was in the yard. No pipe was allowed to be removed from the yard to the trench until it had been cured for at least ten days, and no pipe was allowed to be removed that could not be laid within 48 hours after delivery to the trench.

A maximum of four cement guns were used. The yard coating extended to within 12 inches of the ends of the pipe, the reinforcing extending 6 inches beyond. All angles more than 5 degrees required for the laying of the line were manufactured and gunited in the yard. These angles were cut from the full-length sections and were in most cases gas-welded together.




### HAULING AND LAYING PIPE

After the pipe had been cured in the yard, it was loaded on a specially designed truck and hauled to the trench side. At the delivery end of the tracks in the yard a ramp was constructed for rolling the pipe onto the trucks. Owing to the length of the sections, it was necessary to haul them with truck and dolly as shown on accompanying photographs. In order to prevent damage to the gunite coating, the bolsters of the truck and dolly were provided with a rubber seat. Three sections of pipe were carried at a time, and upon delivery at the trench side the pipe was carefully unloaded from the truck and snubbed to the ground on skids.

The pipe was laid in a trench 39 inches in width, in the bottom of which at least 4 inches of either beach or dune sand had been deposited. The pipe was backfilled with this sand to at least the middle diameter. This was specified in order to provide a uniform foundation for the pipe. The steel pipe was joined in the field with an electric lap weld. After a section of the line approximately 800 feet in length had been laid and the field joints welded, the ends were bulkheaded and it was tested for leakage under a pressure of approximately 125 pounds per square inch. All of the joints were examined while under pressure, and where any leaks or sweats occurred, they were repaired by either calking or rewelding. After passing this test, the joint was given a priming coat of Oronite, followed by a heavy coat of the Petrolastic pipe dip. Reinforcing mesh was then carried around the joint, lapping that installed in the yard at least 4 inches, and then the entire joint was gunited. The bell holes at the joints were made large enough for the field welding and the field guniting. It was found necessary to have at least 30 inches in clearance all around the pipe at the bell holes. Manholes were provided for the painting of the inside of the pipe at the joints as well as for the installation of air and vacuum valves.

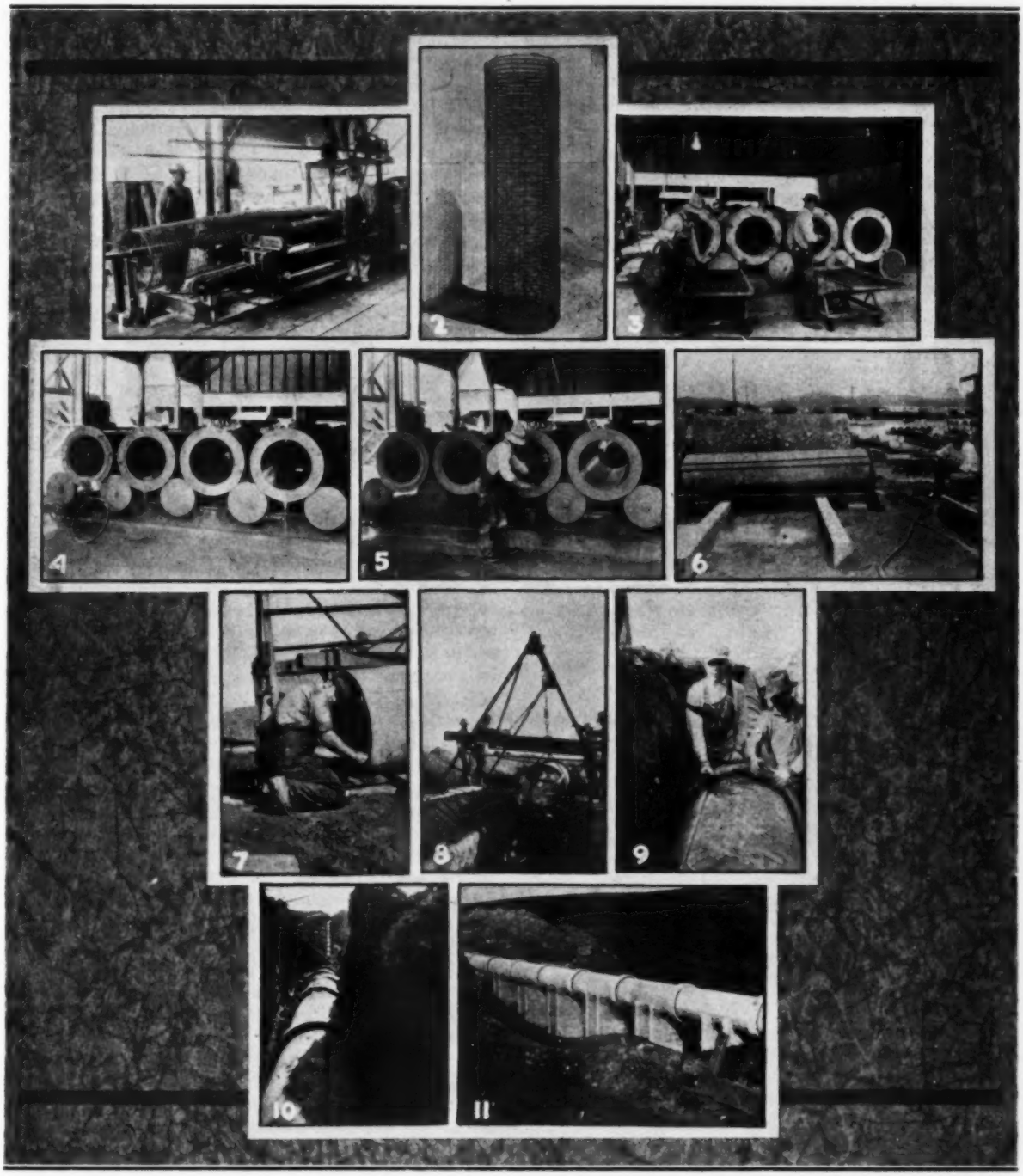
At the point where the line crosses Newport Bay, as shown on the plan and profile, 24-inch flexible cast iron pipe was installed. The method of laying this pipe is shown in the accompanying photographs.

### CONSTRUCTION OF GRAVITY LINE

The gravity portion of the Laguna Beach pipe line consisted of centrifugally spun, reinforced concrete pipe varying from 27 to 18 inches internal diameter. This pipe was manufactured and installed by the Western Concrete Pipe Co. by the "Hume" process.

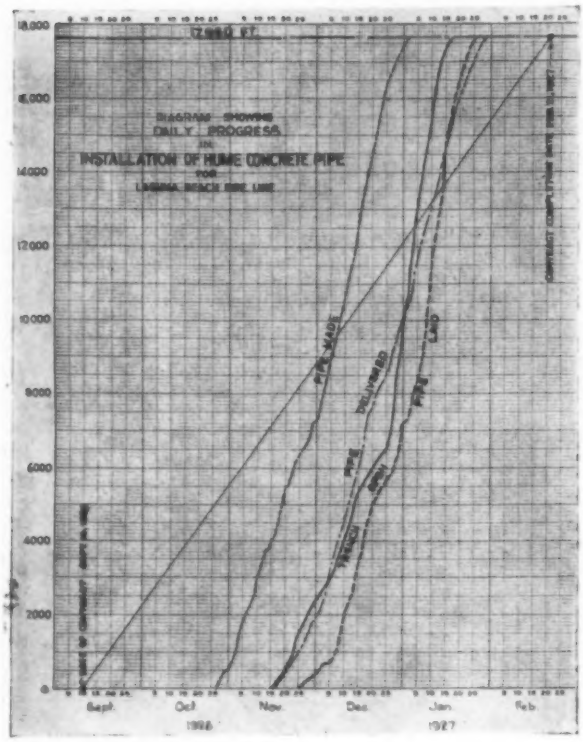
For the manufacture of concrete pipe by the Hume process cylindrical steel forms are supported in a horizontal position on power-driven rollers. These forms are split in the center for removal after the concrete is set. Inside this steel cylinder is placed the steel reinforcing, which has previously been formed. The forms are then revolved and the concrete aggregate is shoveled into the cylinders. The concrete is uniformly spread over the inside of the form, and the steel reinforcing centered by means of the centrifugal force of the revolving cylinder. The speed of the form is increased after all of the concrete has been deposited. As a result of this centrifugal force, a very dense concrete is secured. All of the lighter or latent materials are forced towards the center of the form. After being spun in this manner for a length of time varying principally with the air temperature, they are brought to rest and all of the latent material is removed by means of brushes. After these lighter materials, called "slurry," have been removed, the forms are again revolved at a relatively high rate of speed and the inside of the pipe is burnished by passing a rod back and forth over the interior surface. This gives a very dense coating on the inside of the pipe of almost neat cement with a very smooth finish, resulting in a high coefficient of friction. After the spinning process has been completed, the forms are removed from the machine and are steam-cured for at least twelve hours. Upon leaving the steam chamber, the outside forms are removed and the pipe is further cured for eight days under a sprinkling system in the yard.

Centrifugally spun concrete pipe is superior to the older method pipe made by pouring concrete materials between forms in many respects, the most important of which is the securing of a very dense concrete having a relatively high tensile strength. All of the stress in concrete pipe under internal pressure is tension. The general theory of design is to provide sufficient steel reinforcing to carry the tensile stresses, surrounding the steel with concrete for watertightness. Theoretically, however, the tensile stresses in the pipe are distributed between the steel and the concrete in the ratio of the modulus of elasticity of the two materials. It therefore follows that the steel and the concrete will act together to carry the tensile stresses until the concrete has failed in tension, at which point the concrete will crack and all of the load will be carried by the steel. This has been recognized in the past in the design of reinforced concrete pipe by providing sufficient steel to carry the load with relatively low unit stresses. In designing the pipe for the Laguna Beach line, adequate steel was provided to carry the entire load with a unit stress of 16,000




*MANUFACTURING AND LAYING CENTRIFUGALLY SPUN CONCRETE PIPE FOR LAGUNA BEACH PIPE LINE*

1. *Machine for making reinforcing cage for centrifugally spun concrete pipe.* 2. *Complete reinforcing cage made of No.* 8 *or No.* 10 *high carbon steel wire.* 3. *Revolving forms used in manufacture of Hume spun concrete pipe. Concrete materials are shown being shoveled into the forms after the reinforcing cage has been inserted.* 4. *End of first spin at relatively low speed. Note excess water and lighter materials forced from concrete by centrifugal force. Workman is burnishing the interior of the pipe with a steel rod.* 6. *Testing the completed pipe under internal pressure.* 7. *Applying Petrolastic compound to the male end of pipe prior to laying. This method of joining the pipe was subsequently abandoned owing to leaks that developed under test.* 8. *Lowering pipe into trench for jacking into section previously laid.* 9. *Caulking annular space between pipe and collar at field joint.* 10. *A typical syphon of spun concrete pipe on the Laguna Beach line.* 11. *Spun concrete pipe on piers exposed to severe variations in temperature and expansion and contraction. No leaks have occurred.*




pounds per square inch. The minimum thickness of the concrete shell was then determined by making it adequate to carry the maximum load with the unit tensile stress in the concrete not exceeding 200 pounds per square inch with the load distributed between the steel and the concrete in the ratio of the modulus of elasticity of the two materials, which was assumed to be 10 to 1. For the maximum heads in the Laguna Beach line this resulted in the following shell thickness for the various diameters of pipe:

| Diameter of Pipe | Thickness of Shell |
|---|---|
| 27 inches | 2⅝ inches |
| 24 inches | 2½ inches |
| 18 inches | 1½ inches |

Standard briquettes of centrifugally spun concrete were manufactured and tested by a local testing laboratory. The tensile strength developed varied from 450 to 650 pounds per square inch at 28 days. As the design was based on a tensile stress of 200 pounds per square inch, the factor of safety in the Laguna Beach line under the highest heads is therefore approximately 3 as compared to from 1 to 2 ordinarily obtained with poured concrete pipe.

An important point of superiority of centrifugally spun concrete pipe over the previous methods of manufacture is the method of joining the pipes in the field. With the type of joint used in the Laguna Beach line, it was found that the joint was stronger than the body of the pipe and that a certain amount of flexibility was provided which would permit of the expansion and contraction of the line without leakage.

As the Laguna Beach pipe line was the first line of any size to be manufactured in California, it was necessary to do considerable experimenting before the best results could be obtained. This was particularly true in designing the proper mix, the time and rate of spinning, the type of steel reinforcing to use and the field joint. Specimen pipes were spun, having many variations in the mix. These pipes were tested under hydrostatic pressure. The results obtained were used in the selection of the proper mix to secure the maximum strength and impermeability. The mix finally adopted for the Laguna Beach line was one of cement to 2.3 of sand to 1 part pea gravel. This resulted in the use of 10.35 sacks of cement to 1 cubic yard of concrete in place for the entire job. It was found to be particularly desirable to use a clean sand of uniform grading.

The density of centrifugally spun pipe is best illustrated by its weight and the quantity of materials required for a given volume. Concrete manufactured by this process weighs approximately 155 pounds to the cubic foot, as compared to 145 to 150 for good poured concrete. Approximately 10 per cent more materials are required to manufacture a given volume of centrifugally spun concrete.

### REINFORCING

In the first pipes made for the Laguna Beach Line, the reinforcing was of the ordinary type of cage previously used in the manufacture of poured pipe. This consisted of a spiral of Bessemer steel wire held in position by spacer bars which were flat rectangular-shaped rods approximately ½-inch wide attached to the spiral by punching and crimping the edges. Under the centrifugal force of spinning it was found that this relatively broad bar was thrown close to the outside form because of its weight. In a number of pipes, when the forms were stripped the spacer bar was exposed at the surface. When subjected to hydrostatic test and loaded to destruction, in nearly every instance the pipe failed longitudinally along these bars. To overcome this difficulty, a special machine was devised for winding a cage of No. 8 or No. 10 high-carbon steel wire. This wire was wound spirally back and forth until a cage was formed having the required cross-sectional area of steel and particularly rigid.

### TESTING

After being cured in the yard, 1 out of every 25 sections of pipe was subjected to hydrostatic test pressure equal to 150 per cent of the working pressure. Practically every section of pipe tested showed no cracking or seepage under this pressure. A number of the pipes were tested to destruction. Several sections of 27-inch pipe reinforced for 125-foot head, 14 to 16 days old, withstood an internal pressure of 107 pounds per square inch. Sections of the pipe were also tested from time to time to determine their strength under extreme load. The specified external loads which this pipe should stand were as follows:

| | |
|---|---|
| 27-in. | 3,300 lbs. per lineal foot |
| 24-in. | 3,000 lbs. per lineal foot |
| 18-in. | 2,200 lbs. per lineal foot |

These loads were to be obtained without failure when the pipe was loaded under the standard sand bearing crushing tests. None of the pipe tested failed under this load. The 27-inch pipe failed at a load in excess of 4,200 pounds per lineal foot and the 24-inch pipe at approximately 4,500 pounds per lineal foot.

### HAULING AND LAYING

The pipe for the Laguna Beach job was manufactured

in the contractor's yard in Los Angeles and hauled to the trench side by trucks, a distance of approximately 55 miles. It was laid in a trench having an average cover of approximately 3 feet. The trench was excavated to at least 4 inches below the subgrade of the pipe and backfilled with sand up to at least the middle diameter. The sand was placed in the trench to provide for a uniform bedding of the pipe, which has been found to be particularly important under external loads. On two large pipe lines of reinforced concrete pipe constructed in California in recent years, the only trouble experienced was from failure due to external load, in both cases resulting from improper bedding of the pipe. The sand around the pipe had a further advantage in the heavy adobe soils such as obtained over a large portion of the line, in that it prevented the "heaving" and cracking of the pipe from expansion and contraction of the adobe soils when changing from wet to dry. In a number of cases where concrete pipe has been installed in these soils, trouble has resulted from this condition. At places where the adobe was particularly bad, the sand was carried to the top of the pipe.

### METHOD OF JOINING PIPE

The pipe as it came from the machines was a true cylinder having the ends slightly concave. They were joined in the field by means of a reinforced concrete collar, cylindrical in shape and approximately 8 inches long. The internal diameter of these collars was approximately 1½ inches greater than the external diameter of the pipe to be joined. They were spun in the machines in exactly the same manner that the pipe was manufactured. The inside of the collar was roughened to provide a bond with the joint material. After the pipe had cured in the yard, a collar was centered on one end of each piece of pipe and caulked to within ½-inch of the end of the pipe with a mixture of 1 part cement to 1 part sand. When laid in the trench, the end upon which the collar was fastened was laid in the direction in which the crew was working. Before the next section was lowered into the trench, a mixture of Petrolastic pipe dip and castor oil which had been heated and cooled until in a plastic condition had been formed and was placed on the end of the pipe. The pipe was then lowered in the trench and inserted in the collar and jacked into the pipe previously laid, until the ends of the two pipes were flush together. Under this pressure the plastic material was supposed to completely fill the concave ends of the pipe as well as a portion of the annular space between the pipe and the collar. The remaining space was then calked with a mixture of 1 part cement to 1 part sand. Immediately after the pipe had been laid and calked, the line was backfilled to at least 6 inches over the pipe until the section had been tested. The theory of the joint was that the calking would provide the strength and the asphaltic material would make the joint watertight. During the interval from the time the pipe was laid until it was tested, however, it was found that a considerable part of this plastic material had flowed through the crack between the ends of the pipe and was protrudiing into the interior of the pipe. Upon subjeecting the line to the test pressure, it was found that a high percentage of the joints leaked. After trying many methods for repairing the joint, it was finally found necessary to remove the calking and the asphaltic material in the joints that leaked, and to recalk them with neat cement, almost identically with the methods used in making the cement joint in cast iron pipe. A ring of dry jute was calked into the center of the collar approximately over the joint in the pipes. The other end of the collar was then calked full of neat cement slightly moistened.. After the joints had been repaired in this manner, the line was again put under pressure and was found to be almost watertight, the leakage being but 10 per cent of the specified allowance of 200 gallons per inch of diameter per mile per day.

The line has now been in service for over one year, during which period no leaks of any consequence have developed. A recent test of its watertightness disclosed practically no leakage.

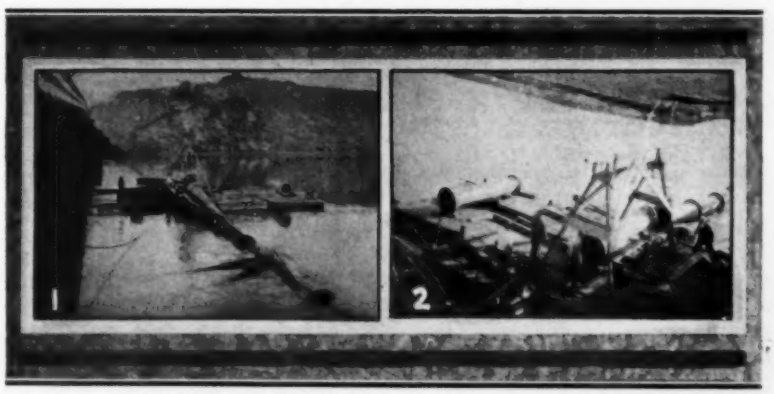
### CROSSING GULLEYS

At a number of points on the line the concrete pipe is carried across small arroyos on piers. The pipe at one point is entirely exposed and subjected to a wide variation in temperature. At the particular point shown in one of the photographs the line also stands empty for substantial periods of time. The temperature range at this point is probably in excess of 50 degrees. With a variation such as this, coupled with the expansion and contraction from the alternate wetting and drying of the concrete as the line is filled and emptied, the joints have been subjected to a particularly severe test. Despite this condition no leakage whatsoever has developed at these points during the past year.

The line throughout its length was fully protected against air and vacuum. Blow-offs were provided at the low points. At numerous places connections were made for taking out water for service to the areas along the line.

### RATE OF PROGRESS

The general contract for the installation of this conduit was let on September 10, 1926, and the specified completion date was February 21, 1927. All of the




*THE CAST IRON PIPE LINE ACROSS NEWPORT BAY*

*At left, laying the flexible joint pipes on raft. Right, close-up of equipment used.*

COST DATA FOR
43,451 Lineal Feet—30-Inch—⅝-inch Gunited Steel Pipe

| Item | Contract Price | Total Cost | Lin. Feet | Cost per Foot: For Quantity Done | Cost per Foot: For Entire Job |
|---|---|---|---|---|---|
| *Trenching and backfill* | | | | | |
| H. W. Rohl, gen'l contractor | | | | | |
| 1. General expense | | $3,349.00 | 43,451 | | $0.077 |
| 2. Machine trench | | $11,005.26 | 39,261 | | |
| 3. Hand trench | | 1,976.25 | 1,879 | | |
| 4. River trench | | 4,544.68 | 1,255 | | |
| Total trenching | | 17,526.19 | 43,451 | | 0.242 |
| 5. Excavation and piers for pipe laid above ground | | 774.00 | 770 | 1.005 | 0.018 |
| 6. Sand for backfill | | 4,160.56 | 34,900 | | 0.096 |
| 7. Bellholes | | 6,193.49 | 41,140 | 0.151 | 0.142 |
| 8. Backfill | | 5,454.01 | 41,140 | 0.132 | 0.126 |
| Total trench and backfill | $1.695 | | 43,451 | | $0.701 |
| *Steel pipe incl. frt. to yard and field welding and painting* | | | | | |
| Steel Pipe and Tank Co. subcontractors | $3.075 | | 43,451 | | *$3.075 |
| *Guniting steel pipe,* including trucking from yard to trench and lowering in trench | | | | | |
| Cement Gun Const. Co. subcontractor | | | | | |
| Yard work | | | | | |
| 1. Plant | | $2,379.74 | 43,608 | | 0.054 |
| 2. Moving pipe in yard | | 243.32 | " | | 0.006 |
| 3. Bracing interior | | 291.96 | " | | 0.007 |
| 4. Reinforcing, labor and material | | 8,351.55 | " | | 0.191 |
| 5. Guniting, labor, material and equipment | | 19,573.31 | " | | 0.450 |
| 6. Curing | | 923.92 | | | 0.020 |
| Total yard work | | | | | 0.728 |
| Field work | | | | | |
| 7. Loading | | 1,247.68 | " | | 0.031 |
| 8. Hauling | | 3,578.96 | " | | 0.088 |
| 9. Laying | | 3,348.07 | " | | 0.083 |
| 10. Field joints | | 4,352.55 | " | | 0.111 |
| Total field work | | | | | 0.313 |
| Total guniting | $1.500 | | " | | 1.041 |
| Total excl. structures and special fittings | $5.270 | | | | $4.817 |

* Subcontract price.

NOTE: The above costs represent field costs only. They do not contain contractor's profit, costs of bonds, or any expenses of contractor's home office. All costs of structures were paid separately and are not incuded in the above costs.

COST DATA FOR
10,573.4 Lineal Feet—27-Inch Hume Concrete Pipe

4578.9'— 25' head
4195.7'— 50' "
594.6'— 75' "
522.1'—100' "
682.1'—125' "

| Item | Contract Price | Total Cost | Lin. Feet | Unit Cost Per Foot |
|---|---|---|---|---|
| Total costs excl. cost of pipe in yard | | | | |
| Western Concrete Pipe Co. subcontractors | | | | |
| 1. Cartage | | $5,361.06 | 10,574 | $0.507 |
| 2. Unloading | | 342.94 | 10,574 | 0.032 |
| 3. Machine trench | $2,992.00 | | | |
| 4. Hand trench | 845.50 | | | |
| Total trenching | | 3,837.50 | 10,574 | 0.363 |
| 5. Bellholes and trimming | | 3,603.90 | 10,574 | 0.341 |
| 6. Sand for trench | | 2,556.33 | 10,574 | 0.242 |
| 7. Pipe laying | | 7,683.06 | 10,574 | 0.727 |
| 8. Caulking | | 1,496.69 | 10,574 | 0.141 |
| 9. Supervision | | 1,935.90 | 10,574 | 0.183 |
| 10. Backfilling, repairing defective joints, cleaning up and all expenses after all pipe laid—prorated | | *7,281.75 | 10,574 | 0.689 |
| Total cost excl. pipe | | $34,099.13 | 10,574 | $3.225 |
| Total average contract price including pipe | | | | |
| 25' head | $5.01 | | | |
| 50' head | 4.65 | | | |
| 75' head | 4.60 | | | |
| 100' head | 5.80 | | | |
| 125' head | 6.10 | | | |

NOTE: The above costs represent field costs only. They do not contain contractor's profit, cost of bonds or any expenses of contractor's home office. All costs of structures were paid separately and are not included in the above costs.

* Incl. prorated costs after Feb. 16, 1927.

pipe was installed by February 1, 1927, but owing to the changes required in the joints of the concrete pipe the line was not put in service until the middle of March. The two diagrams show in detail the progress made for each type of pipe. When pipe was available at the yard, an average of 550 lineal feet could be gunited per day by one gun. On straight going with no steep angles, 1,250 feet of steel pipe could be laid and the field joints welded per day. The best day's laying was approximately 2,000 feet. One crew could gunite about 35 field joints per day. The rate of manufacturing the concrete pipe was limited by the number of forms available. The laying of this pipe was necessarily slow at first, owing to the experimenting necessary to develop the best type of equipment and methods. After the work was organized, they were able to lay about 800 feet per day.

## Costs

The total cost of the Laguna Beach pipe line from the wells to its terminus, including all materials furnished by the owners, was approximately $400,000. The unit prices bid for the various contract items were as follows:

| | | |
|---|---|---|
| 1. | Furnishing and installing gunite steel pipe | $6.27 per ft. |
| 2. | Installing 24-inch Class B cast iron pipe | 3.50 " " |
| 3. | Installing 24-inch Class B flexible joint cast iron pipe | 15.00 " " |
| 4. | Furnishing and installing 27-inch concrete pipe: | |
| | 25-foot head | 5.05 " " |
| | and | 3.95 " " |
| | 50-foot head | 5.75 " " |
| | and | 4.40 " " |
| | 75-foot head | 4.60 " " |
| | 100-foot head | 5.80 " " |
| | 125-foot head | 6.10 " " |
| 5. | Furnishing and installing 24-inch concrete pipe: | |
| | 25-foot head | 3.85 " " |
| | 50-foot head | 4.05 " " |
| | 75-foot head | 4.35 " " |
| | 100-foot head | 5.25 " " |
| | 125-foot head | 6.00 " " |
| 6. | Installing 18-inch Class B cast iron pipe | 2.00 " " |
| 7. | Constructing manholes and installing air valves | 100.00 each |
| 8. | Constructing manholes and installing blowoffs | 75.00 " |
| 9. | Plain concrete | 20.00 per cubic yard |
| 10. | Reinforced concrete | 35.00 " " " |

COST DATA FOR
5,520 Lineal Feet—24-Inch Hume Concrete Pipe

325.1'— 25' head
2580.8'— 50' "
2050.0'— 75' "
266.5'—100' "
297.6'—125' "

| Item | Contract Price | Total Cost | Lineal Feet | Unit Cost Per Foot |
|---|---|---|---|---|
| Total costs, excl. cost of pipe in yard | | | | |
| Western Concrete Pipe Co. subcontractors | | | | |
| 1. Cartage and unloading | | $1,930.50 | 5,520 | $0.350 |
| 2. Machine trench | $1,510.54 | | | |
| 3. Hand trench | 1,506.10 | | | |
| Total trenching | | 3,016.64 | 5,520 | 0.546 |
| 4. Bellholes and trimming | | 1,731.20 | 5,520 | 0.323 |
| 5. Sand for trench | | 1,536.40 | 5,520 | 0.278 |
| 6. Pipe laying | | 3,806.24 | 5,520 | 0.690 |
| 7. Caulking | | 781.58 | 5,520 | 0.141 |
| 8. Supervision | | 865.56 | 5,520 | 0.157 |
| 9. Backfill, repairing defective joints, cleaning up, and all expenses after all pipe laid and caulked | | *3,231.60 | 5,520 | 0.586 |
| Total cost excl. pipe | | $16,949.72 | 5,520 | $3.071 |
| Total average contract price including pipe | | | | |
| 25' head | $3.85 | | | |
| 50' head | 4.05 | | | |
| 75' head | 4.35 | | | |
| 100' head | 5.25 | | | |
| 125' head | 6.00 | | | |

* Includes prorated costs after Feb. 16, 1927.

NOTE: The above costs represent field costs only. They do not contain contractor's profit, cost of bonds or any expenses of contractor's home office. All costs of structures were paid separately and are not included in above costs.

COST DATA FOR
1,570 Lineal Feet 18-Inch Hume Concrete Pipe
1213'—25' head 357'—50' head

| Item | Contract Price | Total Cost | Lineal Feet | Unit Cost Per Foot |
|---|---|---|---|---|
| Total costs, excluding cost of pipe in yard | | | | |
| Western Concrete Pipe Co. subcontractors | | | | |
| 1. Cartage and unloading | | $385.79 | 1,570 | $0.244 |
| 2. Machine trench | $360.00 | | | |
| 3. Hand trench | 101.50 | | | |
| Total trenching | | 461.50 | 1,570 | 0.294 |
| 4. Bellholes and trimming | | 222.56 | 1,570 | 0.142 |
| 5. Sand for trench | | 414.00 | 1,570 | 0.263 |
| 6. Pipe laying | | 429.20 | 1,570 | 0.273 |
| 7. Caulking | | 100.75 | 1,570 | 0.064 |
| 8. Supervision | | 201.66 | 1,570 | 0.128 |
| 9. Backfill, repairing defective joints, cleaning up and all expenses after all pipe laid and caulked | | *657.31 | 1,570 | 0.419 |
| Total cost excluding pipe | | $2,872.97 | 1,570 | $1.827 |
| Total average contract price including pipe | | | | |
| 25' head | $3.25 | | | |
| 50' head | 3.40 | | | |

* Includes prorated costs after Feb. 16, 1927.

NOTE: The above costs represent field costs only. They do not contain contractor's profit, costs of bond or any expenses of contractor's home office. All costs of structures were paid separately and are not included in above costs.

It is interesting to note that the total amount paid the contractor for extra work on the entire job was less than $600. The conduit was installed under very rigid inspection, and costs were kept of all features of the work. The following tables show the unit cost for the various sections together with the contract prices. They contain all field work, including labor and materials furnished by the contractor and cost of equipment used at a reasonable rental price. They do not include any expenses of the contractor's home office, costs of bonds furnished nor profit. The unit costs, while interesting, can hardly be used in connection with new work, owing to the time lost and expenses involved in developing equipment and methods for these hitherto unused pipes. This is particularly true with reference to the concrete pipe.

The conduit was designed and the construction supervised by Roy Browning, representing the Irvine Company, and the Engineering Offices of J. B. Lippincott, representing the District. The writer was resident engineer in charge of the work in the field. Since the start of the Laguna Beach job steel pipe has been gunited for a number of other California water systems, the most important being the Sweetwater Water Co., of San Diego, the East Bay Water Co., of Oakland, and the city of Riverside. Centrifugally spun concrete pipe has been installed for the cities of Riverside, Beverly Hills, Pomona and Sherman, California and at Phoenix, Ariz. A contract has recently been let for the installation of 15,000 feet of 51-inch and 63-inch spun concrete pipe by the city of Tacoma, Wash.

ACKNOWLEDGMENT: From a paper presented at the annual convention of the American Water Works Association.

# Contractors' Accounts

By A. R. M. Boyle

*Treasurer, Lehn & Fink Products Co., New York*

THE accounts of contractors and construction engineers present some peculiar and interesting problems which it might be profitable to discuss. Some of the projects undertaken by this class of business enterprise are of considerable magnitude. It is not uncommon for a single contract to extend over five years or more, and a payroll of from two to five thousand men is not a rarity. Such a contract assumes the proportions of a separate and complete business which would, in itself, be considered of sufficient size and importance to warrant and require the highest degree of organization and the most effective form of executive and accounting control. And, in addition to the hazards of ordinary business, there are frequently encountered engineering problems difficult to foresee, impossible to avoid and far-reaching in their consequences.

Many of these projects are in the nature of public works. A change of government or a political campaign may place the contractor in the unenviable position of having to defend his conduct in a most searching and bitter inquiry. Or the contract may be taken on a cost-plus basis, the accounts being subject to examination by the owner.

There is, therefore, often an added necessity for a contractor to have his accounts and business records kept in such a way as to give accurate and satisfactory information in regard to his affairs.

The divisions of a contractor's organization may be briefly stated as: management, engineering, purchasing, general office, field.

Where the contracts are large and far-flung and not conducted in close proximity to the head office, the tendency is to conduct in the field all the business appertaining to a contract which may safely and economically be delegated thereto, sometimes even a field purchasing office being established.

The field organization, then, may consist of: engineering, superintendence, field accountant and other staff, purchasing, receiving, storekeeper, timekeeper, pay office, in addition to which may be found, for the convenience of the men, a commissary, store and hospital.

In many cases the contractor is subject to severe penalties for delay in the progress or completion of the work. Sometimes attractive premiums are provided for completion in less than the stipulated time. The despatch and precision gained by centering control in the field may therefore far more than compensate for any disadvantages, and it also has the advantage of allocating as direct charges to the job, many items that would otherwise have to be dealt with as overhead.

The expenditures of a construction company may be divided into two chief groups—direct and indirect.

In this division, direct expenditure is meant to include every kind of expense or disbursement that can be definitely charged against a particular contract. Indirect expense is composed entirely of head-office expenses. It includes general management salaries and expenses, head-office purchasing department, accounting and clerical, engineering and estimating not applicable to work in progress, supplies and other office expenses.

## DIRECT EXPENSE

Direct expense may be dealt with under the subheads, labor, materials, supplies and tools, machinery and equipment, miscellaneous and sub-contracts.

The problem of maintaining a force of skilled and unskilled labor at work on a contract at some distance from the centers of employment has always been a difficult one. In recent years, when labor has been scarce and dear under the best conditions, the task of getting men to go into camps miles from any social activities has been an almost impossible one. In one instance which came to the attention of the writer, the labor turnover for one month on a job employing two thousand men, was three hundred per cent. That means that to keep two thousand men on that job for that month, six thousand men had to be hired and six

thousand men quit. This sounds ridiculous, but it was a fact.*

### EMPLOYMENT

Such a condition of affairs necessitates the maintenance of an employment office and a force of employment agents. These agents visit the various employment agencies in the large cities and collect gangs of men to be shipped out to the job, the company's own agent usually accompanying each gang to its destination. In some cases, fees have to be paid to city agencies, and in nearly all cases the fares of the men have to be advanced. The latter are usually deductible from the first earnings. Then, too, these men will have to be housed and fed at the commissary, for which charges are made deductible from wages earned. It frequently happens that men ship in, turn up regularly at the commissary for meals but fail to report at any time for work. In order to prevent this the commissary must be supplied with daily reports of the men on the payroll. It is then the duty of the commissary to see that only such men are accommodated.

Quite frequently when such men are found they simply walk off the job. Fares, commissary and other charges against them are therefore lost. Often they will work a half day or a day and then quit, the charges against them being more than the wages earned, again resulting in a loss to the contractor.

The most common method of dealing with these expenses is simply to charge all such items to employment expenses, fares advanced, commissary losses, etc., as and when incurred, these accounts being in turn credited with any amounts deducted on the payroll. This, however, will not detect any of these losses which are due to the carelessness of the time office or of the pay office in not properly reporting or deducting such expenses from wages. In order to detect these a report should be prepared weekly and submitted to the superintendent or field accountant. This report should be in columnar form with columns for the name of the man, date and place hired, fare, commissary and other advances, particulars of time worked and wages earned, amounts of advances deducted from wages, and advances lost. The totals of the columns relating to advances and deductions must agree with the entries in the corresponding ledger accounts. The particulars of time worked and wages earned need not be filled in where the advances have been wholly recovered. A glance at such a report will immediately reveal any wages that have been paid before all advances were recovered in full.

### TIME KEEPING

The method of time-keeping employed by contractors differs somewhat from that employed by most industrial concerns. In the ordinary factory or works, when a workman enters the gate he is confined within his employer's premises by walls or fences. In most cases he is stationed at a certain point or has certain work to do and his absence from his appointed place would soon be noticed. In any event, he can not leave his employer's premises except through the gate where the timekeeper is stationed.

On a construction job, however, no such restrictions can usually be placed on a man's movements. There is often nothing at all to prevent him, so far as physical barriers are concerned, from leaving the job at any time. In such circumstances the following method of checking time is resorted to.

A daily time-sheet is prepared in columnar form, the columns being headed somewhat as follows:

| Field | | | | Foreman | |
|---|---|---|---|---|---|
| No. In | A.M. | P.M. | Out | Hours | No. Hours |

These sheets usually contain two sets of the above columns and have fifty lines, numbered from 1 to 100. This allows one hundred men to be recorded on each sheet.

When a man is hired he is given a number and a badge with this number on it, which he is expected to wear constantly while at work. These numbers are arranged in series of, say, thousands. Each class of labor is given a different series. Thus, bricklayers may be numbered from 1000 to 1999, carpenters 2000 up, ironworkers 3000 and so on. This method is most helpful to the inspectors and superintendents who can tell by a man's number the kind of work he should be doing.

As each man comes in in the morning he files past the time office and reports his number. This is recorded in the daily time-sheet by the clerks on duty in the "in" column in numerical order. A separate sheet is kept for every hundred. At the same time the man receives a work-card which he takes to his foreman. This word-card is filled in by the foreman as to the number of hours worked and the nature of the work done, or if the man has worked for more than one foreman, by each foreman for the number of hours worked under his supervision. This card is turned in at night to the time office as the man reports out, the clerk on duty marking the time in the "out" column of the daily time-sheet. From the time entered in the "in" and "out" columns the number of hours worked is entered in the "hours" column.

Each foreman is required to make out each day a card showing all the men who worked for him that day, the time worked by each and the nature of the work done.

The foreman's card is first checked from the work card turned in by the men and then the time on the foreman's card is entered on the daily time-sheet. When this is complete, the total time reported by the foreman for each man should agree with the timekeeper's record in the "in" and "out" columns. The analysis of labor or the cost sheets from which the unit costs are prepared are then entered from the foreman's cards. The total of these cost analysis sheets for a week must agree with the weekly payroll.

A further check, peculiar to the class of work, is kept on the time of the men. It is called the field check. As already mentioned each man must wear a badge with his number on it all the time he is at work. The field checkers go over the entire job twice each day, once in the forenoon and once in the afternoon. Their duty is to find and take the number of every man that is working. They return to the time office and turn in their check to the timekeeper. Each man reported by the field checkers is then marked off in the field column on the daily time-sheet. This completes the preparation of the time-sheet. The time shown to the credit of each man is then entered from the time-sheet to the payroll.

* This incident occurred about the time of abnormal building conditions which existed in 1919 and 1920. Labor difficulties are less severe today.

Before leaving the consideration of the time-sheet, however, it may be well to mention another step which is sometimes but not always taken. It can be readily imagined that the field check does not always tally exactly with the time office reports of the men at work. The field checkers are given no information as to the men on the day's payroll. Each checker is given a portion of the job which he has to cover. The men are constantly being transferred from place to place. When the checkers have half finished their check it is quite possible for a man to transfer from an unchecked portion to a checked portion either of the ground covered by different checkers or even within the territory of the same checker. That man will in all probability be missed by the field check. It is also quite easy for a man to be working by himself in some out-of-the-way or hidden corner so that he is missed by the checker, without any great fault of the latter. A man working down in a sewer or up on structural steel work may call his number to the checker. The checker may get it incorrectly and so report as working a number not on the payroll, and fail to report a man who is on the payroll. Inquiry should be made immediately as to all missing men, and in addition a daily and monthly report of men shown missing by the field check should be prepared.

This daily report should show the name of the foreman who reported the man as working. This will form a valuable check on the foremen and indicate any who frequently report men who cannot be found. The monthly report should have thirty double columns, a column for the a.m. and p.m. of each day. The name of the workman should be entered on the left-hand side and each time he is missing from the field check marked. This will indicate the frequency with which a particular man is missed and draw attention to any who make a habit of loafing or absenting themselves from the job.

The payroll should be divided into sections to correspond with each class of labor employed, such as carpenters, bricklayers, etc. Sections should also be provided for foremen and superintendents, purchasing, accounting office, etc. The time is entered from the daily time-sheets. The preparation of the payroll should be subject to approved methods of internal check which present no peculiar features and need not be discussed here. A recapitulation should be made giving the total of each section and the total payroll. The section totals should be charged in the job ledger to the account for each class of labor and the total should be credited to payroll account. Columns should be provided for commissary, stores, hospital or other deductions. All wages paid should be charged to payroll account and not to the labor account.

### Check Your Accounting Methods With This Discussion

*Contractors' accounts, perhaps more than most others, must be designed and fitted to meet the actual needs of each particular case. The procedure outlined in this article might therefore not be desirable in all cases; it might indeed be quite undesirable in some. It may often be quite inexpedient to establish a purchasing office in the field as has been here suggested. These and other matters are to be settled in accordance with the contractor's experience and judgment, the extent of his organization and the problem at hand.*

#### REQUISITIONS

The materials to be used are first dealt with by the engineers and architects in their preparation of the plans and estimates for the work.

The actual requisition usually originates with the foreman in charge of each section and is submitted by him to the superintendent. All material requisitions should be submitted to the engineer in charge of construction for the approval of his department. It is his duty to see that the material requisitioned is in accordance with the plans and specifications and also to keep a record of materials ordered so that duplications may be avoided. Much of the material is ordered from blueprints and is of special pattern and size, as, for example, structural steel. In such a case each piece as ordered should be marked off the plans by the engineer.

In many instances the requisitions originate in the superintendent's or engineer's office.

The approved requisitions are passed to the purchasing agent. It is his duty, not only to keep familiar with market conditions, receive bids, award contracts and place orders for materials, but also to keep accurate records of the materials ordered, quantities delivered and balance due, so that information is available at all times as to the necessity of placing further orders. It is also his duty to see that the materials are on hand at the time required and of the required quality. Any failure to maintain an adequate supply of material may result in delays of the work which may prove expensive.

#### PURCHASE RECORDS

In recording purchases a card record is usually employed. Orders placed are entered both as to name of materials and also under name of vendor. The purchasing department should advise the receiving office of all orders placed and the date when delivery has been required or is expected. Carbon copies of all orders should also go to the accounting and engineer's offices.

The work of the receiving office is most important. A car scale should be provided early, so that the car weights of bulk materials, such as sand and gravel may be checked. The chief receiving clerk should receive a copy of all orders issued by the purchasing department. In the case of specially designed or cut materials such as steel, the receiving clerk should be supplied with sufficient information to enable him to store or deliver to the proper foreman these particular goods. Any failure to do this may result in such materials being cut up or used in a wasteful way for purposes for which they were never intended. These materials if improperly used will then be missing when wanted for work which may have been started with the knowledge that the necessary materials had been received.

The material checkers should not be supplied with full information as to the material they are assigned to check. They may be supplied with descriptions and sizes, if necessary to place and classify the goods prop-

erly, but should generally have no intimation as to quantities. When materials have been checked, a receiving report should be prepared, a copy of which should be prepared, a copy of which should go to the purchasing office, a copy to the engineers office and a copy to the accounting office. The purchasing office makes a record of the materials received so as to keep its record of materials on order correct. The accounting office should enter the receipts on its copy of the purchase order, space for this being usually provided on the back of the purchase order. Invoices are then checked and passed for payment from the accounting-office copy of the purchase order which contains a complete record of goods ordered, prices, terms, quantities received, shortages, damages or other deductions. The invoices when thus passed for payment are charged to the various materials accounts in the job ledger.

The receiving office on a large contract is a complete and important unit. It should be fully equipped. A part of its work is the maintenance of complete and accurate car records from which to refute or substantiate demurrage or other charges which often assume large proportions. Some familiarity with freight classifications and regulations is also essential.

Supplies and tools when received are delivered to the storekeeper. A stock record should be kept of all stores. Supplies are issued by the storekeeper on requisitions signed by the foreman or superintendent. A recapitulation of all stores issued should be made daily and submitted to the accounting office so that the proper charges to material or expense accounts may be made and stores credited.

### Tool and Machinery Inventory

Various methods of checking tools have been adopted. One that is as satisfactory as any is as follows:—Each man is given a tool check when he is engaged. When he needs any tools he is supplied with an order by his foreman. He then goes to the storeroom, turns in the foreman's order and also his tool check and receives the tools he requires. So long as he is in possession of any tools, his tool check remains in the storeroom. When he has returned all tools taken out his tool check is returned to him. Before any man can receive pay on being discharged or quitting, he must return his tool check to the paymaster as evidence that there are no charges against him in the storeroom. It is usual for such items as picks and shovels to be issued to the foremen who take charge of them, issuing them to their men in the morning and collecting them at night.

A contractor's machinery and equipment is all of a movable character and is transferred from job to job as need requires. In many cases equipment such as locomotives, cranes and steam shovels are not owned by the contractor but rented, or the contractor may augment his own equipment during a busy period with rented machinery.

In any event, whether rented or owned, a machinery and equipment record should be kept. In this book a separate account should be kept for each item of machinery. It should show whether each item is rented or owned, and cost or rental, where and when employed, etc.

In the case of rented machinery the charge to be made against the job is simple. It consists solely of rentals paid, repairs and running expenses.

### Depreciation of Equipment

In the case of machinery owned the matter is more difficult. A regular depreciation rate per annum can not always be employed. Depreciation accrues more rapidly on equipment that is in use on a job than when it is in the contractor's shed. It also is subject to greater wear and tear on a job where it is being worked night and day at high pressure than on one where it is employed in a more leisurely fashion. The question, then, is one to be answered according to the conditions surrounding each case.

A method which has been employed, and which would appear to be a most satisfactory one, is to charge all equipment and machinery to the job at a fair value as it is shipped. When it leaves the job it is again valued and the job credited. This method has some advantages especially so far as equipment is concerned. Since the job is charged with what it receives and credited only with what it returns, lost, broken or damaged pieces are not overlooked. For many items of equipment this is the only practicable and accurate solution. When it is employed care must be taken to see that the method of valuation takes into consideration only original cost and wear and tear through use. Any mere fluctuations in market values must be disregarded.

### Sub-contracts

It is usual for the main contractor to sub-let large portions of the work. Any part of a contract may be sub-let but the most common sub-contracts are for plumbing, heating, electrical and machinery installation, etc.

Sub-contracts present no peculiar difficulty. An account should be opened for each sub-contractor. The job is charged with the amount of the contract awarded to him and his account is credited. Payments made on sub-contracts are regulated according to the amount of work done as shown by the certificates of the engineers. Extras, shortages or changes in the work contracted for are adjusted between the job and sub-contractor's accounts as and when determined.

### Miscellaneous Expense

Items of miscellaneous expenses such as photographs, insurance, traveling, field-office supplies and stationery can be charged to the proper expense account in the ordinary way.

As already mentioned, in dealing with labor, the payroll should be divided into sections to record each class of labor separately. All superintendence, field-office salaries, wages of men engaged in the laying and removing of temporary tracks, watchmen and guards will therefore find their way into corresponding larger accounts. Other items of miscellaneous expense will be charged through the voucher register.

### Indirect Expenses

Indirect expenses comprise all expenses that can not be charged against any particular contract, that is, expenses of maintaining the contractor's general office and organization. The only special question here is the apportionment of these expenses over the various contracts on hand, as an item of overhead. In some cases a distribution is not attempted, especially where complete field organizations are maintained. Where, however, all

purchasing and management are conducted from the general office it becomes necessary to apportion general office expenses over the work in hand. This may be done on the basis of materials and labor consumed.

### GENERAL

In the preparation of the annual accounts of a contractor, departure must be made from the general rule that no profit on work in progress can be taken. Anyone who insists otherwise will soon find himself in an impossible position. It is absurd to say that in a contract extending over a number of years no profit is realized until the contract is completed. It is quite possible, indeed most frequently the case, that in the year of final completion only minor adjustments have entered into the work of that year.

It may be that, owing to insufficient accounts or a lack of cost records, it will not be possible to ascertain accurately what profit, if any, has been made on the work done during the year. This is no reason why the entire cost should be treated as work in progress without further investigation. It is just as possible for a loss to have been sustained, and every effort should be made to find out the true position.

In most cases trustworthy cost accounts will have been kept. The engineers are able to calculate with considerable accuracy the value of the work done. Any profits or losses disclosed under such conditions should be drawn in the current year's accounts.

An important question to be considered is that of penalties. If the contractor is subject to penalties for delay in completing the work and the work gets behind so that these penalties are accruing, effect must be given to this condition in the annual accounts of the contractor by charging penalties and crediting penalties accrued. This must be done whether the amount of the penalties has actually been deducted from the contractor's instalment payments or not. If the work is subsequently brought up to the required state of progress the entries for these penalties may be reversed and credit taken.

### COST ACCOUNTS

The all-important thing for a contractor to know is the cost per unit of the work he is doing. That knowledge is the foundation for the intelligent conduct of his business. His viewpoint is not so much that of the accountant as that of the engineer. His costs will not present the same uniformity as those of manufacturing concerns working under settled conditions. To take a simple illustration, the cost per cubic yard of excavations will fluctuate violently as the weather is fair or foul. The contractor is interested, therefore, not only in the results his cost accounts show but particularly in why these results are what they are.

The question of contractor's costs is a technical one. Any discussion of it to be satisfactory would involve the explanation of a great amount of detail which is not within the scope of the present opportunity. Suffice it to say that the objects of a contractor's costs are:

1. To show the progress of the job from day to day or from week to week and to indicate whether the work is being carried out economically or extravagantly.
2. To indicate when, where and why and by how much costs exceed or are less than the estimate.
3. To furnish information for future estimating and to draw attention to portions of work in progress that need particular attention.

To achieve the above objects not only daily unit costs but also average weekly unit costs and average unit costs of work done to date must be furnished.

The cost accounts are built up from analysis of labor and material accounts. Quantities of work done daily should be reported by the engineer in charge of the level and transit.

### CONCLUSION

A comprehensive treatment of the subject of contractors' accounts in all its phases is of course impossible in such a short space. The above remarks are intended, therefore, in a broad and general way. An attempt has been made to bring out only such features as are peculiar to this class of business, and to give a fair indication of some of the conditions that have to be faced.

ACKNOWLEDGMENT: A copyright article used through the courtesy of *The Journal of Accountancy.*

## Variations in Mixing Time on Concrete Highway Projects

A recent survey of the specifications governing the mixing of concrete for highway pavements, made by the Division of Management, U. S. Bureau of Public Roads, indicates that thirty-three states require a 1-minute mix, six a 1¼-minute mix, and nine a 1½-minute mix. Specifications are constantly being changed and a summary of this kind may be in error before it is published.

It must be admitted that absolute standardization of highway practice in all of its elements is neither practicable nor desirable. Conditions vary from place to place, but as a general rule are not so uniform over an area as large as the United States as to justify the adoption of uniform requirements, but in respect to the mixing time of concrete a somewhat different condition prevails. The same kinds of mixers are used from one coast to the other and their mixing action is not subject to regional variations. Cement is a relatively uniform product and water outstandingly so. Aggregates differ considerably and are used in different proportions. There is very little reason to suppose that the variations have any important effect on the physical processes involved. These and other minor considerations suggest that the commonly accepted reason for varied specified practices from region to region, namely, that variations in the controlling conditions compel these variations, does not properly apply in the mixing of concrete for highway work.

*A Bay City Tractor Shovel Powered by a McCormick-Deering Tractor Demonstrating Its Ability to Maneuver on Uneven Ground at an International-Harvester Exhibit in Chicago*

# An 11-Mile Indiana Concrete Road Job

## *With Hauling Done by Subcontract and Using Local Sand and Gravel Tri-Lake Construction Company Averaged Nearly 100 Feet an Hour Pouring Concrete*

ON September 6, 1927, the Tri-Lake Construction Co. began work on its 11-mile contract for an 18-foot, 9-7-9-inch reinforced concrete road from the LaGrange Corp. line east to the Steuben County line in Indiana. The initial work was done near the LaGrange line and concreting of this section was begun about September 23 and continued through November 1. Grading operations were continued and some fill completed from borrow, the whole job being shut down because of cold weather on November 25. Operations were then begun again on grading April 2, 1928, and concreting started April 30.

The sequence of operations on this job was very interesting The road leading from the sand and gravel pit crossed the job about 3½ miles from the east end. The first grading and concreting operations were from the LaGrange line where two miles of concrete were laid. Second, 3 miles of road were completed west from the gravel pit road followed by the 3½ miles east from the road to the pit. During this last operation of concreting the grading gang was working on the rough grade for the remaining 2 miles between the first paving operation and the second paving. This made it possible to haul batches over 3½ miles of completed road for the last 2 miles of paving.

### Grading

There were about 35,000 yards of light cuts and fill on the job, with roughly 10,000 yards of borrow. The grading was handled mostly by an Erie steam shovel followed by Caterpillar 5-ton and Thirty tractors handling the Adams 10-foot grader, Lakewood graderooter and subgrader. This last machine had seen so much service that it was entirely rebuilt during the winter with new timbers by the contractor. Three 42-inch fresnos were also used throughout the job with teams to handle small quantities of dirt on the final grade.

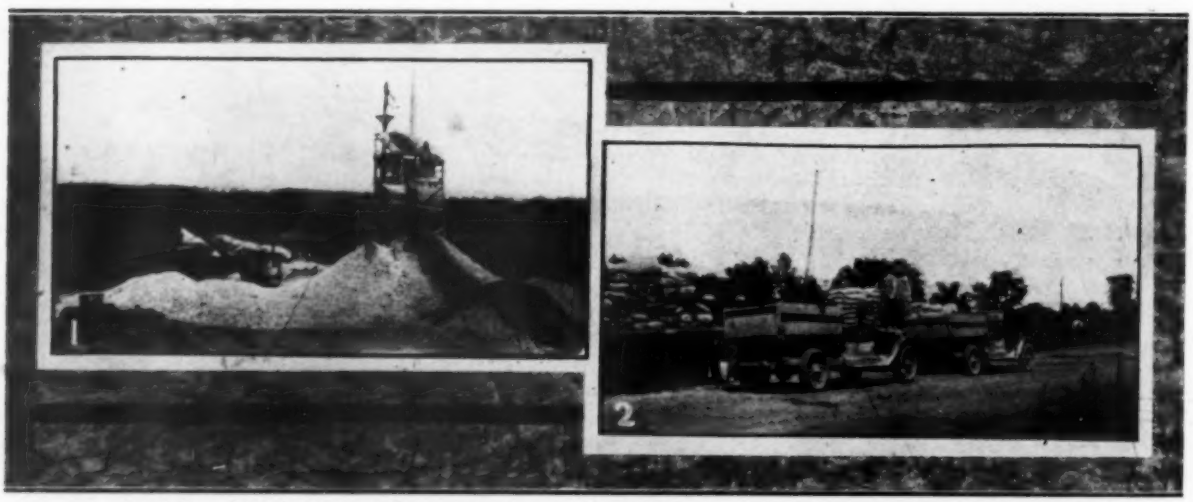
### Fine Grading and Form Setting

A foreman and 15 men made up the gang for fine grading and form setting The Adams grader was used exclusively for preparing the trench true to grade for the forms. Lakewood 12-foot forms were used and dirt spread on the base with larger piles at the joints all along the line to prevent concrete spilled over the edge from adhering to the steel and making the forms unwieldy to handle.

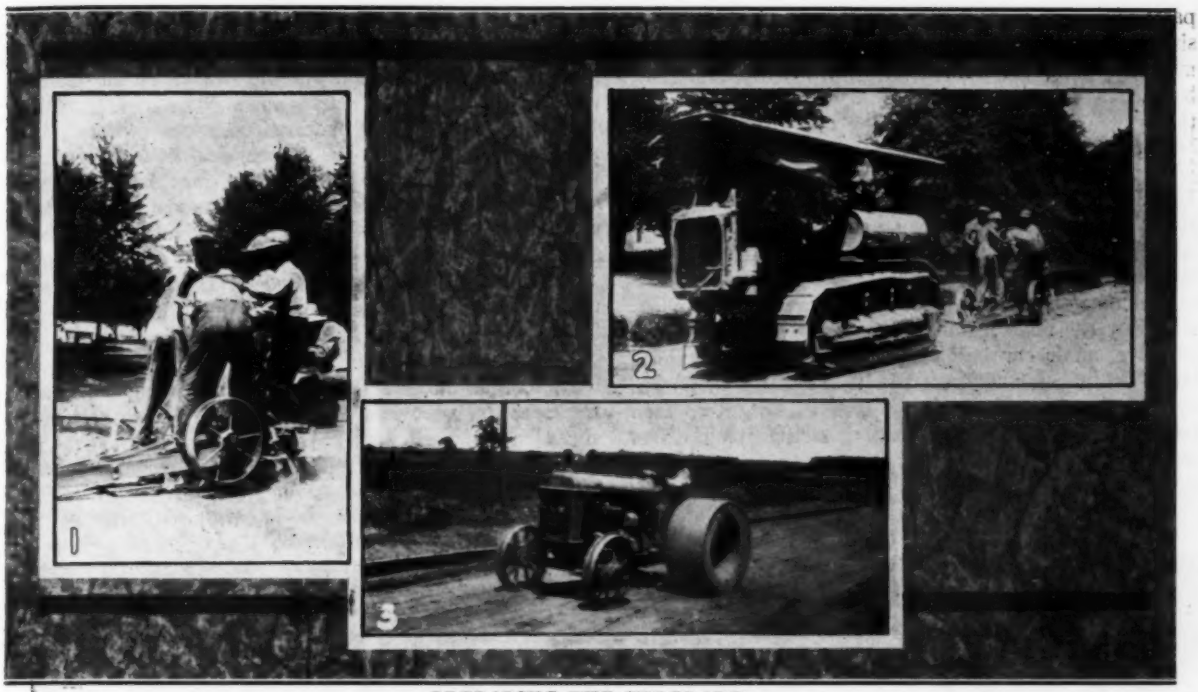
A homemade Fordson roller was used to compact the final grade ahead of the mixer. Wide rim wheels were attached to the Fordson and partially filled with concrete as shown in the illustration. The roller, which cost only about $100 to convert from the tractor, has seen five years of continuous service.

### Sand and Gravel Pit

The sand and gravel pit from which the aggregates for the entire job were hauled is located about one




*Sand and Gravel Production and Cement Hauling for the Tri-Lake Construction Co. Job Near La Grange, Ind.*



*PREPARING THE SUBGRADE*

*1. Riding the Lakewood Graderooter to force it through the old macadam. 2. Caterpillar Thirty pulling the Lakewood Graderooter. 3. A roller made by the contractor from a Fordson tractor and steel wheels filled with concrete. This roller has been in active service for several years.*

mile off the job and about 3½ miles from the east end of the work. It is owned by the Brown-Rosenbarger Gravel Co., of Indianapolis, Ind. Elmer Striebeck was Superintendent. Material is excavated from a deep wet pit by a Pioneer 1¼-yard slackline cableway on a 500-foot line. The material is dumped onto a grizzly with 6-inch openings at the mast. Oversize rolls off to the edge of the pit and the remainder goes to a hopper which feeds by a Smith Engineering automatic feeder to a gravity 2-inch screen. All material over 2 inches goes to the Climax crusher and is brought back by a belt conveyor to the 2½-inch screen.

The fines passing the 2½-inch screen are scrubbed and go to a Telsmith settling tank. The dirty water and silt flows over the rim and returns to the pit while the clean sand is valved off at the bottom of the tank. Stone coming from the end of the Good Roads rotary screen go to the washed pile and that passing the screen goes to two sections of a gravity screen with sprays of water for final rinsing.

The Pioneer bucket is operated by a 12 x 12-inch Thomas steam hoist. Both gravel and sand are handled from their respective stock piles to the Johnson wooden bins and steel batchers by an Erie crane and Hayward clamshell bucket.

### Hauling Batches

The hauling of sand, gravel and cement was sublet to G. T. Miller of Lebanon, Ind., who used 20 Chevrolet trucks with steel dump bodies for handling the batches from the sand and gravel pit to the mixer. A complete double checking system was used to show the number of loads hauled by each truck and in total. At the gravel pit the hauling contractor maintained a complete repair shop for the trucks in charge of a master mechanic who cared for any minor repair or adjustment as the truck pulled in or major repairs after hours or Sundays. A total of 18,080 batches was hauled in 44 working days with the average round trip of 6½ miles.

Each truck as it delivered its load at the mixer received a check on which payment was made to the hauling contractor. As the truck reached the gravel pit this check was delivered to the contractor himself with a paper bearing the number of the truck and the name of the driver. The paper was punched and returned to the driver as he came from the batcher with his load ready to go out to the mixer. A complete record of the amount of gasoline and oil used by each truck together with the record of number of trips made, gave full information on the performance of each truck and driver for each day.

The Wabash cement was hauled by the same contractor from a siding about eight miles distant at Stroli, Ind. The cement was handled by five Chevrolet trucks and stocked on two platforms about a half mile from the junction of the gravel pit road and the road on which concrete was being laid. At this point 7 bags of cement were loaded on each one-batch truck as it stopped at the platform. Two men handled the cement on each platform both for unloading the trucks from the cement plant and for loading the batch trucks. The hauling contractor moved about 4½ carloads of cement daily with the five trucks.

### Concreting

The batch for concrete was a 1:2:3 proportion with the gravel in sizes from 2½ inches to ¼ inch and 2

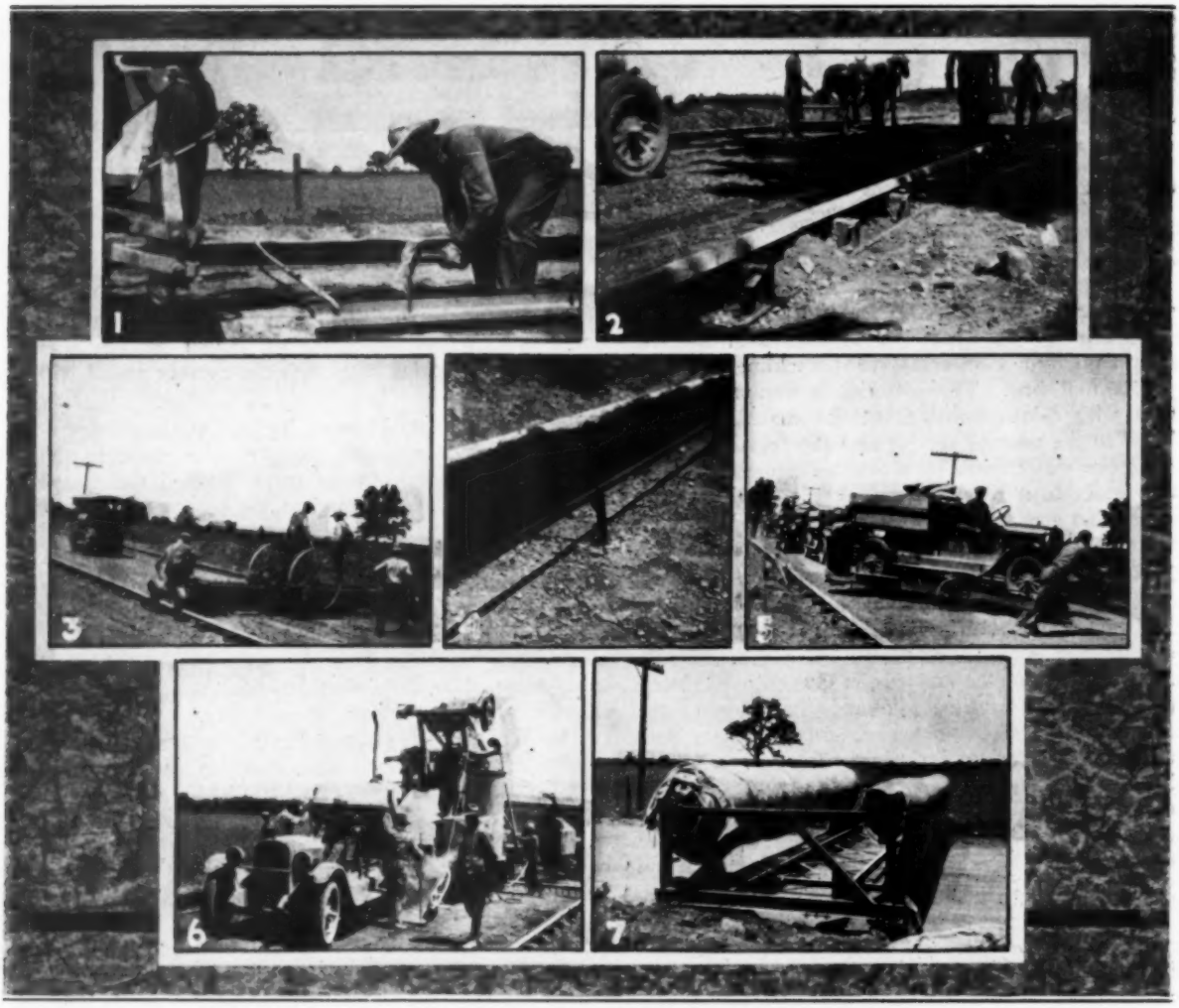
parts of sand below ¼ inch. The concreting gang consisted of one man who operated the Hug turntable, 2 men emptying the cement from the sacks onto the batch, and 2 men dumping the trucks and seeing that the subgrade was wet down ahead of the mixer. Behind the mixer were 2 men who set the Truscon center joint with a ⅝-inch by 4-foot dowel on 5-foot centers. The dowel was pinned with but one pin alternated on either side of the joint. This saved one operation and steadied the dowel and center joint sufficiently. These same men also worked on the final trim for the grade behind the mixer as the final grade checker was pulled ahead by the mixer. This was a home made, but very effective, affair consisting of a 4-inch pipe with holes bored through for sharpened bolts set to the final contour of the subgrade with a 2-inch crown. Two men handled the spading and spreading assisted by the two subgrade men when needed. One man operated the Lakewood finisher shoveling in front of it as needed. One man operated the Lakewood hand belter and with another man cared for all the final hand finishing of the edges. These men also operated the 10-foot home made hand floats to iron out any waves in the pavement before the initial set began.

The Rex 27-E paver operated on a one minute mix spreading the batch on the subgrade so as to minimize the shovelling needed. The shovel men handled the setting of the ¾-inch round continuous dowel bar placed 6 inches from the edge and 4½ inches from the top.

No admixtures are permitted in Indiana specifications and no transverse expansion joints are used.

### CURING

As soon as initial set had begun and the surface was free of water the burlap was laid. The Tri-Lake Construction Co. used long rolls of burlap mounted on a bridge running on the forms. These were easily run out by two or three men as the work progresses. One man was employed to water the burlap of the day's




*SUBGRADE AND CONCRETING OPERATIONS NEAR LA GRANGE, IND.*

*1. Setting Truscon center joint showing gage for centering the steel. 2. Well-aligned forms. Note the care with which the base and the joint of the forms are covered with dirt to prevent adhesion of concrete. 3. A Caterpillar Thirty hauling the subgrade planer. 4. Method of supporting dowels at forms. 5. Turning a truck on the Hug turntable. 6. Dumping a batch from one of the fleet of Chevrolet trucks into the skip of the mixer. 7. Rolls of burlap for preliminary covering of concrete during curing.*

run and another man to water the previous day's run, which was covered with straw. The straw was watered for 14 days and the pavement opened for use in 17 days.

The average run of pavement per hour for this concreting crew has been 97.5 feet. On four successive days from June 11 through June 14 the runs were 1,243, 1,160, 1,109, and 1,140 feet. On June 15 work was delayed by a three hour tie-up at the gravel plant, but by every man getting onto his toes the hourly run was as high as 130 feet and 1,000 feet of pavement was poured.

PERSONNEL

The Tri-Lake Construction Co., Columbus City, Ind., is composed of W. Y. Brand, President, who handles matters pertaining to hauling and aggregate; C. C. Deal, Vice-President, who is responsible for concreting operations, and H. G. Bollinger, Secretary-Treasurer, who handles grading and structures. This Federal Aid Project was constructed by the State Highway Commission of Indiana with Eugene Berkey as Resident Engineer.

## How Many Hauling Units to Serve the Shovel?

SINCE a power shovel can, in general, only dig material when vehicles are in position to receive it, the adequacy of the hauling equipment has a very decided effect on production. The number of hauling units of any given kind which are required varies almost directly as the length of haul, which generally varies between rather wide limits and often at rapid irregular rates. The characteristics which affect the rates at which the material can be dug by the shovel sometimes also change with unexpected frequency. In practice, therefore, it is found inadvisable to attempt to maintain an exact balance between the hauling equipment supplied and that just needed to maintain the highest rate of production of the shovel. Consequently, in many instances, a definite number of hauling units is sent out and maintained on the job until it is completed. The result is that on very short hauls some of the equipment is idle or working at slow rates while on the longer hauls not enough equipment is available to keep the shovel at a high rate of production. The question thus becomes one of determining what hauling equipment should be sent out in order to complete the job at the lowest possible cost.

Since it is general practice to maintain a fairly definite number of hauling units on the job, the utilization of the otherwise idle time on short hauls therefore becomes a matter of considerable importance. At present, the general practice is to begin the fill at the first point of the cut so that as the work proceeds the distance between the shovel and the dump continually increases. The result is that a large portion of the hauling equipment is idling when the cut is begun, but before the end is reached the shovel is not working a considerable portion of the time. A better method, which can frequently be employed is to begin the fill at the balance point or a sufficient distance away from the beginning of the cut so that as the work proceeds the dump and the shovel will both progress in the same direction and with a haul sufficient to utilize the full equipment to the best advantage. Whenever possible, the placing of fill should be so planned that the idle time lost for the hauling equipment will be reduced to a minimum. Surplus teams may often be used with fresnos to do cleaning up work usually done with the shovel.

Various types of hauling equipment are used with the power shovel. The most common are teams and bottom dump wagons, motor trucks and large tractor-drawn bottom-dump

*A Full Dipper Load of Easily Worked Material and a Short Swing. Such Conditions Should Produce a Large Output*

wagons. Teams are used more frequently than any other type and in general are very satisfactory for short to moderate hauls. The time required for turning, dumping and maneuvering is relatively short and their average round trip speeds are fairly constant and from 220 to 240 feet per minute over a wide range of road conditions. On jobs which have very wide variations in the lengths of haul and especially if the longer hauls involve considerable quantities, the use of teams is apt to be uneconomical unless the conditions are such that either extra teams can be hired when needed or else that when the shorter hauls are reached the otherwise idle teams may be satisfactorily utilized on wheeler or fresno work.

Some of the difficulties of team hauling, especially for the longer hauls would no doubt be reduced by a more general use of the 2-cubic-yard, 3-horse wagon. Where team hauling is used the daily cost of remaining idle may readily reach the normal daily operating cost. Consequently, with a team outfit it is generally very important that work be carried on whenever it is at all practicable to do so.

This item is prepared from a portion of the excellent discussion of power shovel operation in highway grading released by the United States Bureau of Public Roads and prepared by T. Warren Allen, Chief, Division of Management, and Andrew P. Anderson, Associate Highway Engineer of the Bureau.

## Building Construction Throughout the Year

THE Seasonal Operations Committee of the New York Building Congress, B. H. Wait, Chairman, very definitely reports, "No valid argument against continuous all-year building operations exists today." The investigation of this committee so far shows that a 12-months building program is desirable, practicable and profitable. In the past, it is true, owners, architects and contractors were loathe to begin actual operations during fall and winter months, but that condition is rapidly changing as the facts of successful operations are known.

Many of the largest building organizations operating in the eastern United States, according to Mr. Wait, have concentrated on continuous production of buildings and have reached the point where lay-offs due to weather are no greater in winter than in summer. This may seem a startling observation, but it is nevertheless, substantially accurate. The usual winter depression in building can be avoided and every branch of the industry and allied interests benefitted by continuous operation. The stability produced by an even spread of building the year round is of more than passing interest to the economic welfare of the Community, when it is considered that the volume of construction in the New York Metropolitan District alone approximates a billion and a quarter annually. Employment during the winter months means that the economic stability of business will be maintained. Not only men employed on construction work, but those supplying building materials and engaged in the many lines touched by construction are able to retain their standards of living.

# Concrete and Material Control at Coolidge Dam

By Bruce Johnston

*Testing Engineer, U. S. Indian Irrigation Service, San Carlos, Ariz.*

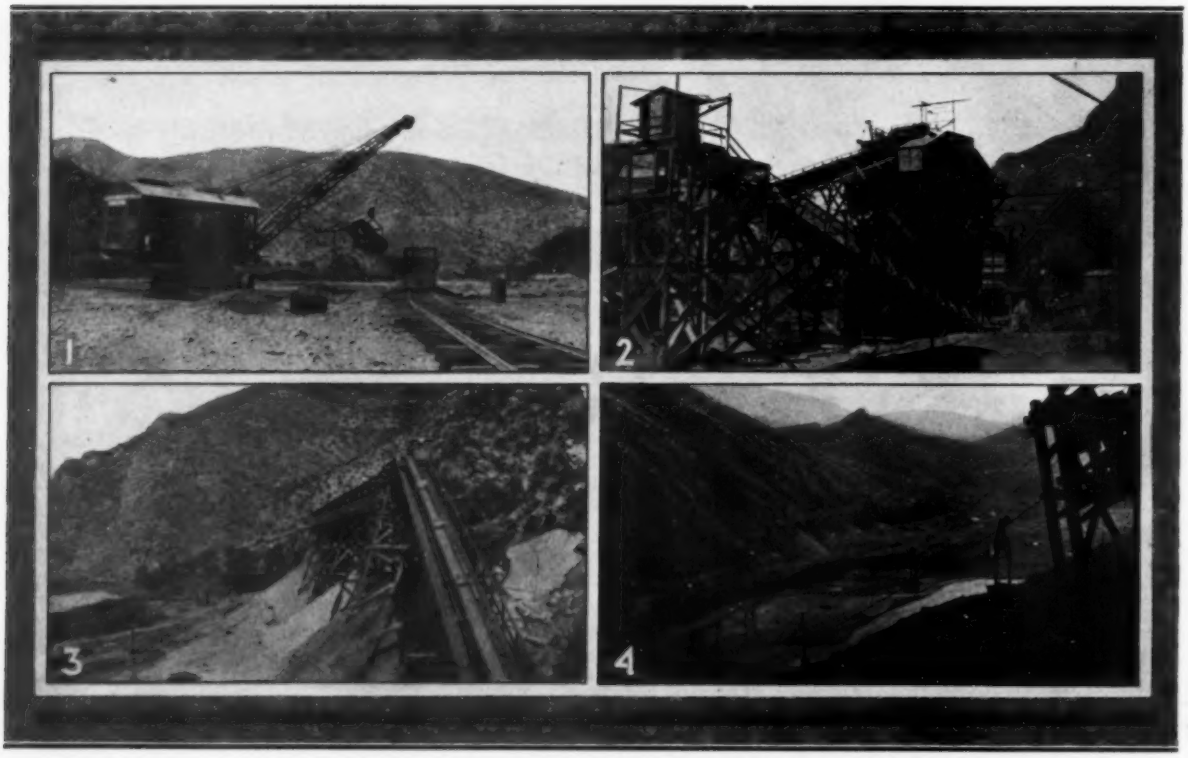
THE construction of the Coolidge Dam near San Carlos, Arizona, was commenced in January, 1927, and is at present nearing completion. The first concrete was poured on November 24, 1927. The novel design of this structure was first conceived and planned by Major C. R. Olberg, Assistant Chief Engineer of the U. S. Indian Service, and the finished dam will rise 220 feet above the bed of the Gila River. The construction of this project involved the placing of about 5,800,000 pounds of steel. The methods and care taken in controlling the quality of materials and concrete used in a structure of this type is a problem of great importance, and is taken up in the following paragraphs.

## General Requirements

The qualities most essential in concrete for a structure such as the Coolidge Dam are water-tightness, strength, durability, and economy. In some parts of the structure such as at gate openings, resistance to water erosion is also a problem which must be considered in connection with durability. Still more important than the mere existence of these qualities is their consistent maintenance at a uniformly high standard in every batch of concrete placed in the structure.

The initial step in obtaining good concrete is the procuring of good materials. Concrete may be defined as a material composed of cement, sand, broken rock or gravel, and in mass concrete, cobble rock, well mixed and brought to a proper consistency by the addition of water. The detail specifications controlling the quality of these materials are quite lengthy and comprehensive and all of the ingredients used in the concrete placed in the Coolidge Dam have been rigidly held to a high standard of quality.

The factors which affect concrete quality are so numerous and involved that it is often difficult to place the credit or blame upon any one thing, when, as the case may be, good or poor concrete is obtained. As already mentioned, the quality of the materials used demands first attention. The grading of the mix and its




*PRODUCTION OF AGGREGATE FOR THE COOLIDGE DAM*

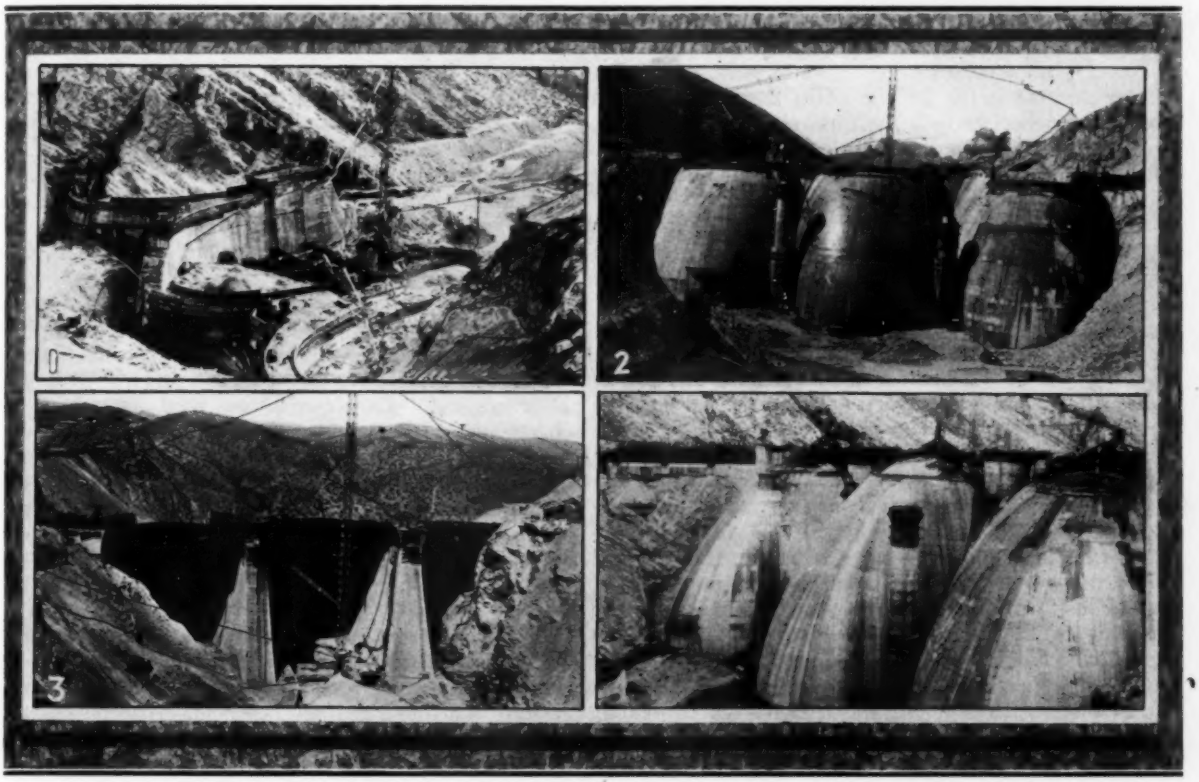
*1. Bucyrus 50-B dragline ready to load river gravel into industrial cars being spotted by Plymouth 8-ton locomotive. 2. The screening plant. 3. Gravel plant stock piles. 4. General view of gravel plant showing tramway break over tower in right foreground*

effect upon the workability and density of the concrete, the water-cement ratio, the time of mix, the temperature of both the concrete and the air, the methods used in placing, and finally, the care taken in curing, are some more of the many interrelated problems which must be dealt with in economically securing good concrete.

### THE GRAVEL PLANT

The layout and equipment for handling materials at the gravel plant is modern and complete, the plant being capable of handling 3,000 tons of material in a double shift of 16 hours. Sand and gravel are both obtained from a large bar in the Gila River bed which is located about half a mile below the dam. A very large variety of rock is found in the bar but by far the largest percentage is quartzite. The gravel plant and stock piles are located in the canyon adjacent to the main bar, which is about 800 feet wide at this point. At present, the initial handling of the material is done by a 50-B Diesel Bucyrus dragline and the rock and sand is then hauled in three trains, each of four industrial dump cars, by 8-ton Plymouth gasoline locomotives to an Allis-Chalmers 24 x 36 jaw-crusher. After passing through the first crusher, which serves only to bring the large plums down to a size where they may be handled on the conveying belt, the material is transferred by belt to the screening and washing plant. Belting was furnished by the Pioneer Rubber Co.

Two Allis-Chalmers rotary screens 22 feet in length segregate the gravel into the two largest grades; ¾-inch to 2½-inch, and 2½-inch to 7-inch. The entire screening and washing plant is of dual construction and a breakdown of any one unit does not necessarily stop operations. Oversize rock is crushed in two Allis-Chalmers gyratory crushers, No. 5 and No. 7½, and then run through the plant a second time. Small rock and sand which is washed through the ¾-inch screens is carried to a rotary cone screen having 5/16-inch round openings. This screen separates the finest grade of rock from the sand, which is thoroughly washed in two Bodinson washers. The water which is used in washing the sand and gravel is taken from a settling basin close to the river and pumped by a Byron-Jackson centrifugal pump which delivers about 1000 gallons per minute. There are four small bins in the screening plant which temporarily retain the material until it may be conveyed by belt to the large open stock piles. A third belt conveyor runs in a tunnel underneath the stock piles and serves to carry the rock and sand to the tramway loading terminal, which is located at the north end of the stock piles. An aerial tramway having a horizontal length of 2200 feet and a vertical lift of 285 feet carries the product of the gravel plant to the mixing plant bins in ½-yard buckets.




*Stages in the Pouring of the Dome Sections of the Coolidge Dam Showing Forms and Concrete Chuting Equipment*

### MIXING AND PLACING CONCRETE

The mixing plant is located about even with the top of the dam on the west side of the canyon and is only a short distance below the downstream face of the structure. It has four large bins for storing aggregate, each having a capacity of 600 cubic yards. Cement is brought in by truck from the nearest railway station, San Carlos, which is nine miles from the damsite. The

cement is unsacked and hoisted by a bucket elevator into a cement silo having a 9000-sack capacity.

There are two Smith mixers, each having a capacity of two yards, which alternately mix and discharge concrete. All of the materials fed to the mixers are measured separately in automatic Blaw-Knox batchers, the sand and coarse aggregate being measured by volume and the cement for each batch being weighed. The water is measured in a tank with an open gage and the quantity is varied to maintain a uniform consistency, the control of which is explained in a following paragraph. It is specified that the concrete be mixed for at least two minutes.

After leaving the mixers, the concrete runs in an open steel chute to the lower hoist tower hopper. The steel hoist tower is centrally located in the canyon bottom below the dam, has an over-all height of 408 feet, and elevates 2½ cubic yards of concrete at each lift. After being elevated to the desired height the concrete is fed by another hopper into the final chuting system and placed in the structure. The concrete is thoroughly tamped and puddled while placed and this operation is under constant inspection. In the main part of the structure 4-foot lifts were used and each pour ran from 400 to 1200 cubic yards. The finished pour is wet down immediately after the concrete has set and is kept wet until a succeeding lift is made.

### Proportioning the Mixture

There are at least half a dozen different methods of proportioning concrete which have been used in different places and at different times, but to-date there has not been developed a general rule of design which will work automatically for any set of conditions and any theoretical conclusions which may be made in designing a mix must be tempered by the application of practical experience and knowledge and be further checked by actual test. The strength, density, water-tightness, and economy of concrete are all affected primarily by the grading of the sand and coarse aggregate. For any given combination of cement, sand, and aggregate, the strongest concrete will result from the mix which contains the least amount of water and is yet workable. This is merely an indirect statement of the water-cement ratio law but the important fact is that the lowest water-cement ratio which may be used in any one case is directly limited by the range of workability of the mix and the workability is in turn determined by the grading of the total aggregate. If the best grading of the total aggregate is determined and kept uniform the mix will have a constant range of workability. Then if the desired consistency be kept constant it follows that the water-cement ratio will be kept constant. Further, a uniform grading of the total aggregate obviates the greatest cause of inaccuracy in the slump test. Provided the above precautions are taken, the slump test may therefore be relied upon to maintain a constant water-cement ratio within close limits.

The above is essentially what has been done in the work at the Coolidge Dam. At first, several prevailing methods of design were tried, but in the mix which was finally worked out after a large number of experimental batches had been mixed and tested, special care was taken to see that the grading of the total aggregate was a smooth and even curve when plotted. The intention to keep the total aggregate in the mix well graded and uniform has been simplified by the fact that the out-put of the gravel plant has been segregated into four different classes as explained in the description of the plant. The only difficulty which has been encountered is the fault common to the cone-shaped stock pile in which the coarse rock runs down the sides and the very fine rock remains in the center. This has caused a little trouble in the case of the ¾- to 2½-inch gravel but has been taken care of by varying the amount of fine rock in the mix. Numerous sieve analyses of both sand and gravel were made at the start and minor changes made in the mix until the work became adjusted and uniform concrete was being produced. Tests of strength and density have indicated that the concrete being placed in the Coolidge Dam is of exceptionally high grade.

Two general classes of concrete have been placed in the dam. One class has been used in the domes, outlet towers, and auxiliary structures where a comparatively high strength is desired. A 1:2.7:3.5 mix has been used for this class of work but wherever the structure was massive enough to permit the use of cobble a 1:2.7:3.1:2.8 mix was used with practically equal strength and much greater economy. In the latter mix only one barrel of cement is needed per yard of concrete. The strength specified for this class of work was 2200 pounds per square inch at twenty-eight days but the average strength to date has been better than 2900 pounds per square inch. The second general class of concrete was placed in the buttresses and a 1:3.1:3.6:3.2 mix was used. Cobble rock was used throughout the buttresses. Specified strength was 1800 pounds per square inch with the actual 28-day strength to date averaging better than 2500 pounds per square inch. In the spillway floors a 1:3.8:5.3 mix without cobble is being used and the 28-day strength has averaged about 2000 pounds per square inch.

### Testing of Materials

A complete testing laboratory was equipped before the start of the work. The equipment includes a 100,000-pound Riehle hydraulic testing machine, a tensile testing machine, and all other miscellaneous testing equipment conforming to standard specifications. The test cylinders are cured under water in a concrete tank.

All of the cement used in the Coolidge Dam is tested at the mills by the U. S. Bureau of Standards before shipment to the dam. As a check against weather conditions and handling it is again tested at the dam for normal consistency, time of set, and 7-day mortar strength in both tension and compression using a 1:3 mortar of normal consistency with standard Ottawa sand.

Samples of sand were taken from the gravel plant several times a week at the start of the work and continued until a general knowledge was obtained of the quality of sand in every part of the bar. The tests included the decantation test for silt, color test for organic material, and a sieve analysis with the determination of fineness modulus. Sieve analyses have been made regularly on the ¾ to 2½-inch rock and all of the gravel has been carefully watched for the presence of any dirt, foreign articles, or inferior stone.

Samples of concrete for making up test specimens have been taken, if possible, from each shift during which concrete has been placed from the start of the

work. The samples are taken from the concrete actually in place in the structure as soon as possible after it has come through the chutes. Three 6 x 12-inch cylinders are made at one time by the standard method and on the following day are taken to the testing laboratory and placed under water. In the present case it is believed that curing the specimens under water gives a fairly close check on the actual strength in the structure because curing conditions in a massive dam closely approach the ideal.

A summary of the average monthly strengths and slumps based on tests of 1116 cylinders broken up to July 1, 1928, is here given:

*Dome Concrete* (1.00 bbl. per yd.)

| Month | Slump in. | 7-Day Strength lbs. sq. in. | 28-Day Strength lbs. sq. in. |
|---|---|---|---|
| 1927 | | | |
| Nov.-Dec. | .... | 1590 | 2746 |
| 1928 | | | |
| Jan. | 5.48 | 1907 | 3329 |
| Feb. | 5.24 | 1606 | 2929 |
| Mar. | 4.85 | 1683 | 2799 |
| April | 4.58 | 2028 | 2990 |
| May | 4.54 | 1831 | 2740 |
| June | 4.24 | 2332 | 3215 |
| Average | 4.82 | 1854 | 2964 |

*Buttress Concrete* (0.90 bbl. per yd.)

| | | | |
|---|---|---|---|
| 1927 | | | |
| Dec. | .... | 1468 | 2908 |
| 1928 | | | |
| Jan. | 4.98 | 1608 | 2690 |
| Feb. | 4.87 | 1297 | 2353 |
| Mar. | 5.10 | 1425 | 2614 |
| April | 4.53 | 1680 | 2560 |
| May | 4.89 | 1456 | 2189 |
| June | 4.70 | 1860 | 2942 |
| Average | 4.84 | 1542 | 2608 |

Besides the routine work connected with the testing of materials considerable experimental work was carried on in the testing laboratory. Several problems peculiar to the conditions found at the Coolidge Dam were worked on and a method worked up to quickly give the correct mix to meet any strength requirement which might arise. It was also found that by wetting the coarse aggregate before it went into the mixer hopper, a noticeable increase in strength resulted.

### SUMMARY

Making concrete, at its best, is a process which must be continually watched if uniform results are to be expected. The factors which control concrete quality were briefly outlined in a preceding paragraph. During the work on the Coolidge Dam problems have arisen which involved practically all of these factors but they have all been satisfactorily solved and the test results, tabulated in the preceding paragraph, speak for themselves.

### PERSONNEL

In conclusion, credit should be given to Atkinson, Kier Bros., and Spicer Co. for the remarkable record they have made to date in handling the contract for the Coolidge Dam. The excellence of the installation and operation of their plant and equipment and the spirit of cooperation which they have maintained with the government engineers from the start of the work has been all that could be desired. Major C. R. Olberg has had general charge of supervising the work for the U. S. Indian Service. The skill and energy of J. G. Tripp, Superintendent for the contractors, and the constant watchfulness and careful supervision of H. C. Neuffer and C. H. Southworth, government engineers, have achieved a fine record of construction performance which is marked by the placing of 200,000 yards of reinforced concrete between November 24, 1927, and September 30, 1928.

*2-Ton Caterpillar Tractor Removing Forms from Concrete Wall*

## Large Highway Project Under Way in New Mexico

A FIFTEEN-MILE road construction job was started in the southern part of the Rio Grande Valley, N. Mex., early in September. The contract price is $236,694. Three hundred working days are allowed the contractor to complete the job. The work consists of grading, drainage and surfacing with crushed rock or gravel. There are two large bridges on the job with a number of small ones. One of these bridges of creosoted timber construction is to span the Rio Grande River. Veater and Davis of El Paso, Texas, are the contractors.

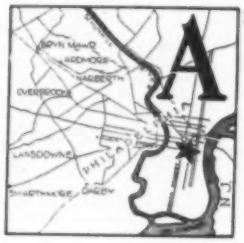
## Hauling With Teams and Wagons

HIGHWAY construction organizations are generally composed of a number of interdependent units from which full production can be secured only when the capacity of each of the subordinate organization units is at least equal to the capacity of the primary producer and properly synchronized with it. A power shovel grading outfit as commonly operated on highway work is such an organization. It is obvious that no matter what capacity the shovel may have, its output, except when casting, can never exceed the capacity of the hauling units which are moving the excavated material. To secure a high rate of production at the shovel, it is imperative that the hauling equipment handle this production at an equally high rate. If the distance over which the material is hauled were constant, the number of hauling units of any given kind required to handle the output could be determined readily. After these had been supplied the problem would be narrowed down to the correct management of the equipment and the use of correct methods.

In practice, no such fortunate conditions exist. The hauling distance frequently varies greatly from day to day and sometimes from hour to hour. It is seldom practical to supply the hauling equipment needed to maintain full production on all lengths of haul because of the capital and carrying charges involved. Teams and wagons are today the cheapest means of transporting the output of the power shovel to the dump where the haul does not exceed 500 or 600 feet and there is room for efficient handling, but it would be a mistake to state that this will continue to be the case. Motorized equipment is rapidly being developed to higher efficiency and it is believed the time is not far distant when performance in terms of volume, speed and cost will give it precedence over teams and wagons even on short hauls. Development has already reached the point where this is true under some working conditions.

# Sheathing and Shoring Excavations for Philadelphia College Building

By Daniel J. Hauer



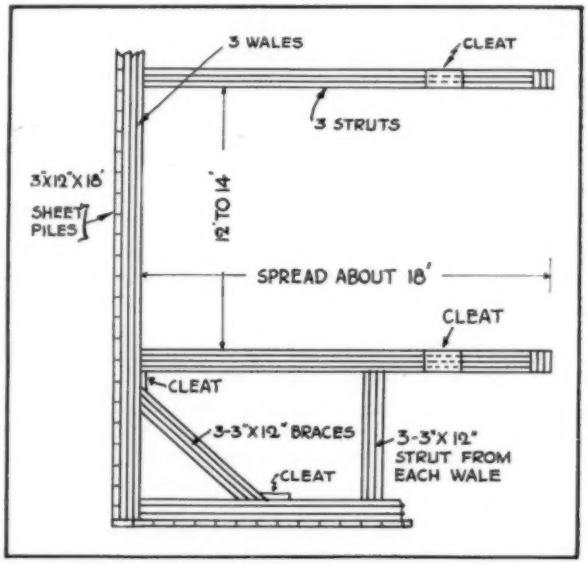
A SHORING and sheathing job for a building excavation and basement in Philadelphia, Pa., on the new building of the Jefferson Medical College at Walnut Street between 10th and 11th Streets, is of especial interest because of the sizes of timber used. It was a simple job of sheathing the three sides of a building excavation, to be 158 feet x 112 feet and shoring the sheathing to prevent cave-ins. The structure is to be twelve stories high and the excavation for the sub-basement has been carried down to a depth of about 17 feet below the curb line.

Striking features about the shoring and sheathing are four. First, its simplicity. Second, no useless work has been done and the minimum of timber has been used. The effectiveness of the work is shown in the sheet piling which is particularly well driven and stands vertically. Third, the perfect alignment of the sheathing and shoring, and, fourth, all of the work has been done with 3 x 12-inch planks, not a piece of heavier timber having been used either for wales or struts.

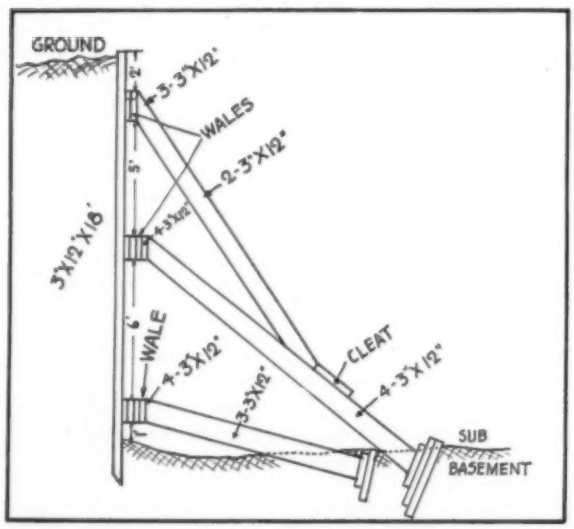
### Smaller Timber Cuts Expense

The use of the 3 x 12 planks saved considerable money in purchasing and placing the timber, for it is generally possible to purchase plank up to about 24-foot lengths for less money per thousand feet board measure than timbers 10 x12 and 12 x 12 inches. The smaller dimension timbers are handled by men for much less money than the heavier sticks of lumber and on excavation jobs of this kind with steam shovels and ramps, it is seldom possible to erect derricks to handle timbers for shoring and bracing as this work is done in great part simultaneously with the shovel work.

The contractor used two Bucyrus-Erie steam shovels in excavating the 11,000 cubic yards of sand and gravel to obtain the elevation and grade of the sub basement. The materials were loaded into Mack 5-ton trucks and hauled up the incline. The excavation was dry so that pumping was not necessary.




*Plan of Corner Bracing and Shoring for Sub-Surface Work on the Jefferson Medical College*




*Wales and Struts Made of Two or Three 3-inch Planks Nailed Together*

### Sheet Piling

The sheet piles, all 3 x 12-inch lumber, were driven by hand. This is the only feature of the work which might be criticised. Mauls for driving sheet piling, with iron bands when needed on the pile head, and the use of man power can frequently make a good looking job, but for 7700 feet of piling it would certainly have been more economical to have used a small air hammer and a portable compressor. The work would have looked just as well, could have been done more rapidly per foot and at less cost, even if a compressor had to be hired for the job.

### Wales and Struts

For wales and struts the contractor nailed or cleated together two or three of the 3-inch planks as shown in the illustration. The wales were placed 5 or 6 feet apart, the upper one being made up of two planks and the two lower ones generally of four planks. Three pieces were used for waling. The center one was shored

by a strut made up of four planks, securely braced against the ground. The footings were made of three planks of different lengths, much easier to place and wedge tight than it would have been if heavy square timbers had been used. On this strut was placed a cleat, and a strut made as shown in the illustration was run to the top waling. These struts were made of two planks in most cases, but in cases of undue pressure three planks were used.

This made an effective brace and yet was much less expensive than it would have been to run the struts to the basement floor. The lower wale was shored to an independent footing with a strut made of three planks.

At the corners between each waling piece three planks were placed as corner braces and held by cleats. Thus, three braces appear one above the other. Then struts were framed to fit between the wales and the struts were run at right angles to them. This held the corner rigidly. Large wire nails were used, not only to nail the planks together but also to toenail one piece to the other, thereby saving cutting up much timber for cleats which would also have had to be nailed.

The cost of this new college building of brick, steel and concrete construction is estimated at $1,500,000. It will contain a recreation hall, laboratories, class rooms, museum and amphitheatre. The contractor for the excavation work and shoring was McNichol & Co., of Philadelphia, Pa., while the general contractor is Doyle & Co. of Philadelphia. The architect is Horance Trumbauer.

## A Record Pour of Concrete on a Los Angeles Subdivision Road

THIRTY thousand square feet of concrete poured in four hours is the record established recently on the Vermont Knolls Subdivision paving job in Los Angeles, Calif. The run for the day was 48,000 square feet, this being the total in spite of a 2-hour breakdown in the plant during the noon hour. This record was made possible through the use of the Hunt Process of concrete curing.

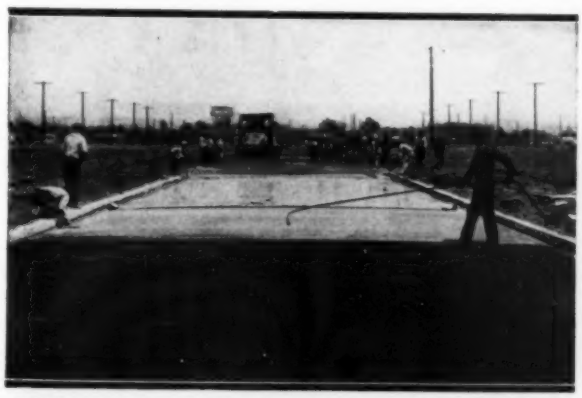
The job was poured from a central mixing plant which consisted of two 9-sack batch mixers. The concrete was then hauled to the job in 5-yard trucks. When this particular record was made, work was started in the center of the block and two spreading crews were used, working back to back. On the previous day running in the same manner, they had laid 47,000 square feet of 6-inch concrete pavement in eight hours, so that they decided to run the mixing plant to capacity to see how much concrete could be laid in eight hours.

The two spreading crews started at eight o'clock in the morning, and at 12 o'clock they had 30,000 square feet laid and finished. During the noon hour the plant broke down, and the crews were delayed about two hours. Work was resumed and 18,000 square feet were run during the last two hours, making a total run for the day of 48,000 square feet.

McEverlast, Inc., developer of the Hunt Process, had been notified of the proposed run, and had two spraying outfits on the job with a crew of two men each. It was found that only one rig was necessary, so the other rig was sent to another job. Covering this job with burlap, and then covering it with dirt in accordance with city specifications, would have been an impossibility in the length of time that it took the Hunt Process to do the work of finishing.

The total square footage of this job was approximately 450,000 square feet. The daily average run was approximately 40,000 square feet. The contractor had planned his work carefully, and had prepared the subgrade for the concrete almost completely before starting to pour. This was possible because the job was in a new subdivision and there was no city traffic to be taken care of. The contractor stated, during the running of the 30,000 square feet, that had he been able to use eight more trucks, he would have almost doubled the pour, and that the capacity of the mixing plant had not yet been reached.

The Hunt Process now used by contractors throughout the west and many sections of the East, entails the curing of concrete with its original moisture by sealing the surface of the freshly laid pavement with an asphalt preparation applied with sprayers immediately after pouring the mix. It was first given official sanction by the Los Angeles City Council about a year and a half ago and has since been approved by public works by 56 cities.



***Applying the Hunt Process to a Portion of the 30,000 Square Feet of Concrete Poured in Four Hours on the Vermont Knolls Subdivision, Los Angeles, Calif.***

## The Five Ages of Construction as Seen by the Public

'SWUNNAFUL how them shovels eats dirt, ain't it? See her bust right through that wall? One them things cert'ny throws a lot o' men out o' work, don't it? I kin remember when this proppity could 'a been bought for almost nothin'. Wonner if he's gonna be able to pick up that big fellow. By gosh, he done it! 'Swunnaful, ain't it?

Wonner how far them foundations go down. Must take a lot o' cement to fill up them holes, huh? You said it! My gran'father could o' bought some o' this proppity when you could get it for $10 a acre. Wonner them foundations hold all that weight, ain't it Them cement mixers must throw a lot o' men out of work, huh? See how they pour the cement through them pipes? 'Swunnaful, ain't it?

Close the window, Miss Smith, the racket's enough to drive you crazy. Gaw's sake, George, how do you ever get any work done with those damned riveters goin'? My notes show it's the way I got it, Mr. Henderson; mebbe those hammers were goin' so's I couldn't hear—those fellows climb around like a lot of monkeys, don't they? My brother owned some of that ground thirty years ago; if he'd only held on to it he wouldn't have to worry none now. Look at that fellow ridin' that derrick! 'Swunnaful, ain't it?

'Swunnaful how they start puttin' on the bricks in the middle of the buildin', ain't it? you wouldn't think them bricks would hold, the way they slap 'em on, would you? Them elevators throws a lot of hodcarriers out of employment, don't they? My aunt owned this proppity when it was worth about a dollar a foot; wish she'd held on to it. Well, what do you know about that? I was here yestiddy and they was on'y up to the sixth floor. 'Swunnaful, ain't it?

Ever see anything like it; no sooner'n they get 'em up than they start tearn' 'em down again! 'Swunnaful, ain't it?

—Joseph Fulling Fishman in the New York *World*.

# Steady Plugging Overcame Weather Handicaps

By H. P. Chapman

*Engineer Inspector, Bureau of Construction, Ohio State Department of Highways*

THE Dunzweiler Construction Co. of Zanesville, Ohio, was awarded a contract for paving a 6.8 mile section of the Zanesville-Caldwell road in Muskingum County with concrete on September 17, 1927. This being its home county it was especially anxious to make a good showing—both as to progress and quality.

The section had been graded during 1926 and 1927 under a separate contract which made it possible for the company to start paving almost as soon as the plant could be set up.

Although the construction season was well advanced and many other contractors were preparing to shut down for the winter, the Dunzweilers began organizing the job immediately and by means of several unique time saving methods were able to complete three miles of pavement before actually closing down for the season.

### Spring Operations Delayed

The progress in the spring of 1928, however, was not so encouraging but this was through no fault of the contractor. The soil on almost all of the project is a sticky red clay which retains moisture very tenaciously and renders paving impossible during damp weather.

Spring operations could not be started until early in May and from that time on until July 1, the weather was such that the mixer operated only a few days. During the month of June it rained every day except three; but in July the weather was such that they could operate at something near a normal rate, finishing the placing of concrete August 1.

No records were broken so far as daily runs were concerned, yet considering the exceptional progress in the fall of 1927 and the unfavorable weather during 1928, the quality of the work, the difficult location and other features, this project can be considered one of the outstanding concrete pavement jobs recently undertaken in Ohio.

The topography along the location of the new road is somewhat rough and, while it cannot be characterized as mountainous, it is such that there are many curves and grades. The maximum grade on the project is 8.5 per cent for a distance of 1400 feet. Grades of over 5 per cent are encountered in several other places. Of the total length of contract, 2.1 miles are on curves.

The design used was the standard 18-foot concrete pavement, 7 inches thick at the center and 9 inches at the edges, with a steel center joint and edge bars.

### Unloading and Batching

Washed gravel was used as the coarse aggregate. The materials were transferred from the cars to the batcher by means of an Orton crane. This piece of equipment gave very satisfactory service and no delays were suffered on account of breakdowns. Any excess material was stock-piled, but due to careful work on the part of the contractors in ordering materials and following up shipments, very little of the material was rehandled. A Johnson batching plant was set up, spanning the roadway. This was made possible by the proximity of the railroad to the highway and by the fact that the highway was closed to traffic during construction.

### Subgrade Prepared at Night

One of the unusual features of this contract and one that speeded up the work, was the method of preparing subgrade. This work was done at night by an extra shift of men. A portable Delco lighting plant equipped with a powerful searchlight was used.

A force of about 20 men started work on the subgrade as soon as the mixer shut down in the evening. This enabled them to carry on the work without being interrupted by the trucks. A definite amount of work for the next day's run was laid out in preparing the subgrade and setting the side forms. As soon as this was done the men were released. The work was generally completed between midnight and 2 A. M.

No difficulties were encountered due to inaccurate work and the form setting and operation of the subgrade machine could be carried on without interruption due to hauling. This method, considered with reference to the general progress, was found to be more economical than doing it during the day.

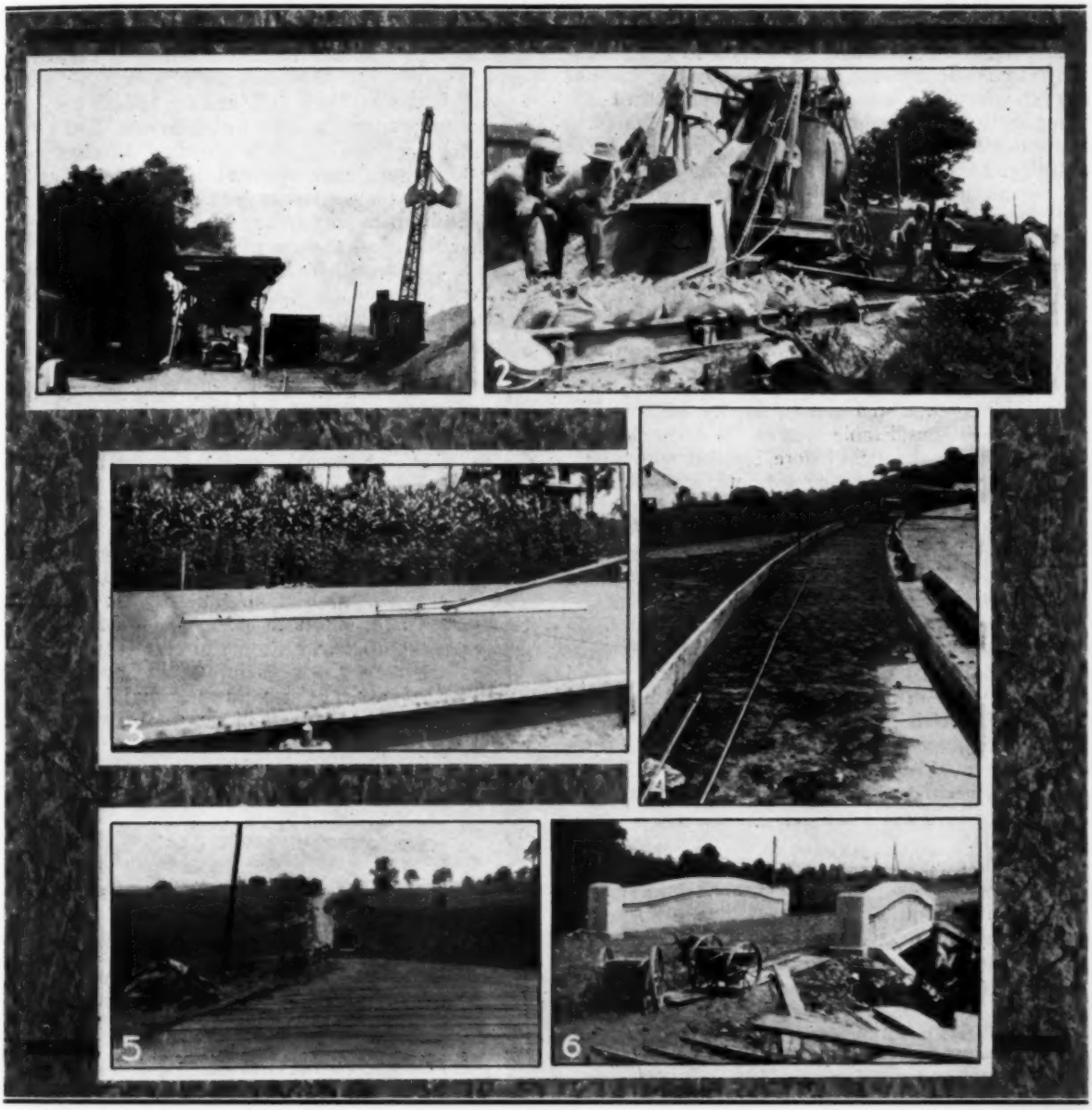
### Hauling

Eleven 2-batch Hug trucks were used on the job. The cement was hauled from the plant. It was frequently delivered hot, which necessitated maintaining a storage shed at the batching plant. No cement at a

*Subgrade Completed and Forms in Place. A Result of Night Work by the Grading Gang*

temperature in excess of 140 degrees Fahrenheit, was used in the concrete.

Eight of the trucks were used in transporting aggregates from the batching plant to the mixer. With the lighter trucks and the pneumatic tires used, the subgrade, which had been prepared the preceding night, was left in almost perfect condition.



*FEATURES OF THE DUNZWEILER JOB ON THE ZANESVILLE-CALDWELL ROAD*

*1. Orton crane serving Johnson bin and batchers mounted across road. 2. Koehring 27-E paver waiting for trucks. 3. Straightedging the pavement 50 feet back of the mixer to detect irregularities. 4. Widened section on curve showing center joint at edge with protruding dowels. 5. Burlap covering immediately behind paver. 6. Curing a section of pavement with hay. A typical concrete culvert with ornamental walls*

### MIXING AND PLACING

Placing concrete began October 6. The proportions were 1:5 making allowance for the bulking of sand, with a minimum cement content of 6.7 bags of cement per cubic yard of concrete. The mixing time requirement was 1¼ minutes. A Koehring 27-E mixer was used which gave a uniform, well-mixed product. Because of the steep grades it was necessary to pour the concrete at a slump of about one inch.

The Ord finisher used on the job handled the dry concrete in a satisfactory manner. Very few honeycombed or irregular spots were left after the finishing machine had passed over the concrete the second time. By careful form setting and operation of the finishing machine, it was possible to eliminate practically all hand finishing. No hand floating was done unless absolutely necessary. The surface was straight-edged about 40 or 50 feet back of the finishing machine but the care

taken in the previous operations made the straight-edging rather monotonous—very few irregularities were found.

The average daily output was about 700 feet. The largest day was 857 feet.

### PLACING CONCRETE ON CURVES

The method adopted for placing concrete on curves contributed very materially in maintaining the large daily output. In finishing curves, the finishing machine was run around the inside 18 feet of the pavement. The forms, set to accommodate the finisher, were graded to conform with the super-elevation. To provide for the widening, an extra strip of center point was placed against the outside forms, half the dowel extending into the concrete and the other half bent at right angles into the groove in the steel joint next to the form. The widening was then placed with another mixer after the concrete had hardened sufficiently to bear traffic.

### CORING AND CORRECTING SURFACE

Wet burlap was spread over the surface as soon as the concrete was hard enough to sustain it. Very little laitance was encountered, due to the dry mix, but hair checks caused considerable trouble. Wetting the subgrade thoroughly the night before, together with a light sprinkling just before placing concrete, sprinkling the concrete with a fine spray back of the finishing machine and placing the burlap as soon as possible, reduced the number and size of the hair cracks, but nothing was found which could be said to be an absolute guarantee against their appearance.

The burlap was removed the morning after and the surface checked with the "bumpometer." The bumpometer is a straight-edge fitted with a wheel at each end and a free wheel in the middle, so arranged that when the middle wheel is ¼-inch above or below the line of the two end wheels a bell rings. All irregularities thus found were marked and corrected. High spots were rubbed down with a carborundum brick. As many as three bumps in a day's run was the exception rather than the rule.

The final curing was done by covering with earth and keeping it wet for the required time.

During the fall of 1927 the mixer actually worked 21 days, giving a daily average of a little over 700 feet per day. No accurate check on the operating time for the mixer could be kept for 1928, but hour for hour it is believed that the production would equal that of 1927. While this is not by any means a record breaking performance, it is very creditable for steady production.

### ENGINEERING AND INSPECTION

Grade stakes were set on both sides at 50-foot intervals on tangent and at 25-foot intervals on curves. They were set to the grade established for the previous contract but frequent adjustments were made in order to supply an adequate amount of dirt for berms.

Two inspectors were employed, under the supervision of an engineer, one at the batch meter and one at the mixer. The inspector at the mixer was also responsible for the curing and for checking the previous day's run with the bumpometer.

Tests for sand bulking were made by measuring a quantity of sand volumetrically before and after inundating. The per cent of bulking thus found was taken into account in determining the volume of sand used for each batch. These tests were made about once a week, or oftener if the moisture content of the sand varied.

Yield tests were made by mixing a one bag batch in the proportions used and measuring the concrete produced. This method has, however, been superceded by measuring an entire batch from the paver in an open bottom box of adequate size. The latter method is more accurate and also checks the setting of the batch boxes.

Slump tests were made daily and 6 x 12-inch test cylinders were prepared at 1000-foot intervals. The average strength of the cylinders tested at 14 days was 4280 pounds per square inch and of those tested at 28 days 5200 pounds per square inch.

A portion of the surface has been tested for smoothness and shows an average of less than one bump in 500 feet. Core tests have not been taken, but the pavement will be cored for thickness and the cores tested for compressive strength.

### BERMS AND DITCHES

The berms were finished by throwing up the dirt from the ditches with a blade grader and distributing it with slip scrapers. Final trimming to the exact cross section was done by hand. Lastly they were rolled with a light roller.

### CONCLUSION

This project was not spectacular in any one respect but it shows what can be done by steady plugging.

The contractors were at all times honest and conscientious in their efforts to meet requirements of the specifications and seemed willing to go more than half way to cooperate with the engineers and inspectors.

Walter G. Smith, Division Engineer and A. T. Connor, Resident Engineer, were in charge of the work for the State.

## Elements of Highway Engineering

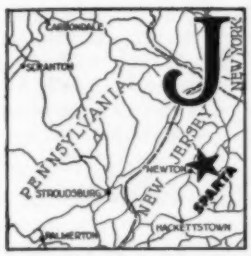
THE second edition of "Elements of Highway Engineering" first published in 1915, has been announced by John Wiley & Sons, Inc., New York City. The authors, Arthur H. Blanchard and Prof. Roger L. Morrison, Department of Highway Engineering and Highway Transport, University of Michigan, have prepared an excellent text book devoted to the fundamental principles of highway construction. As stated in the preface the book presents "fundamental principles rather than to****specifications and details of construction and maintenance methods." The contents by chapters are an historical review of ancient eastern hemisphere and early American highway, financing and administration of highway improvements, highway transport surveys, highway design, surveying and mapping, grading, drainage and subgrades, earth and sand clay roads, gravel roads, water bound macadam roads, bituminous materials, dust prevention and bituminous surfaces, bituminous macadam pavements, rock asphalt and sheet asphalt pavements, bituminous concrete pavements, portland cement concrete pavements, brick pavements, stone block pavements, wood block pavements, street cleaning and snow removal, comparison of roads and pavements, sidewalks, curbs and gutters, highway structures. The price is $3.75.

## Damage from Accidental Injuries

The November issue of CONTRACTORS AND ENGINEERS MONTHLY will contain a valuable article on this subject which all contractors should study.

# A 1.5-Mile New Jersey State Aid Road Job

## *Contractor Uses Hand Finishing Methods On County Concrete Road at Sparta, N. J.*



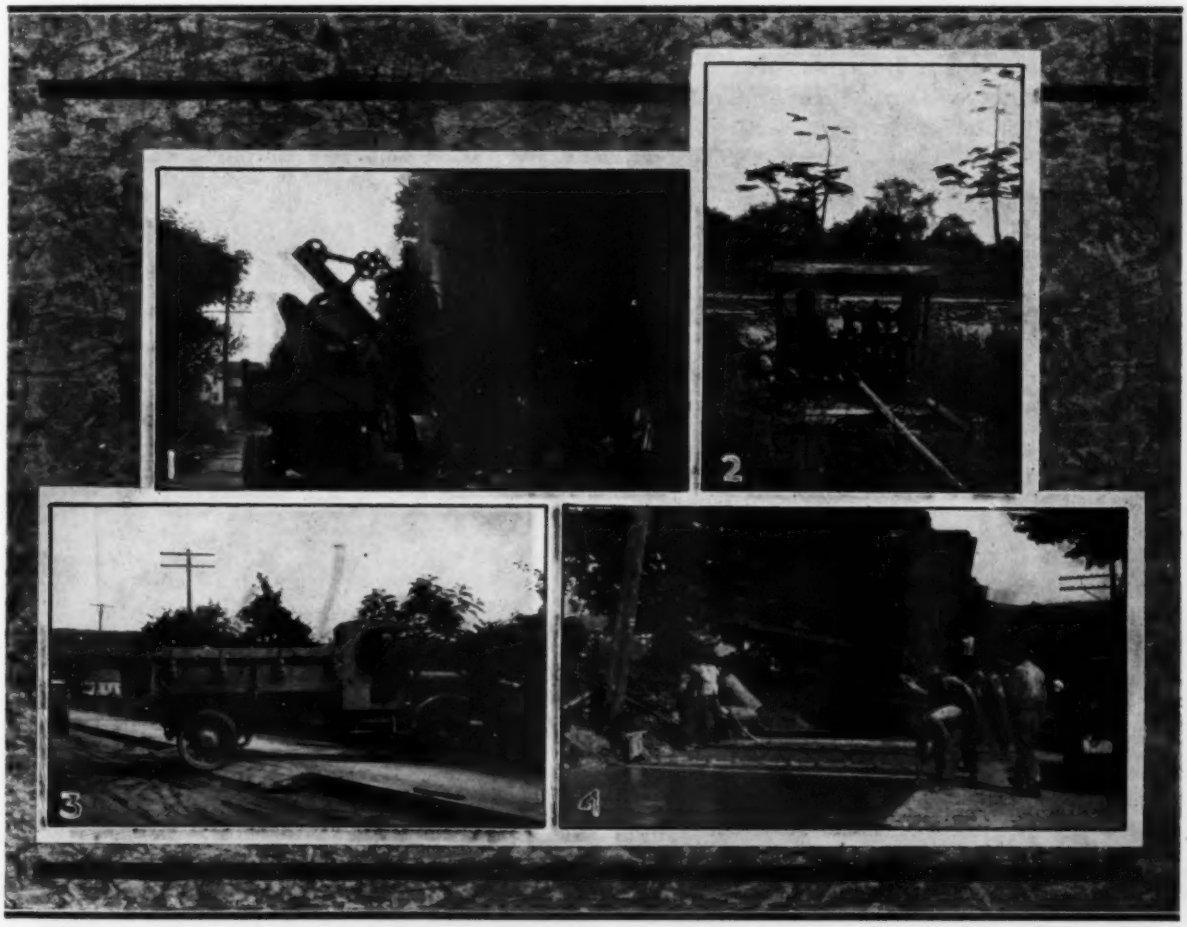

JOHN F. McGREEVEY, Manasquan, N. J., recently completed 1.5 miles of reinforced concrete pavement running from Sparta west toward Newton, N.J. This is a Sussex County State-Aid job and was built in two 15-foot strips with Carey Elastite between. Traffic was maintained over the old grade while the first strip was being laid and then over the cured strip while the second was poured.

### Grading

Grading operations were carried on well in advance of paving by a Keystone excavator equipped with a skimmer scoop. This loaded directly to small trucks which hauled the excavated material away. There was practically no fill on the job as grading operations were confined to removing the old oiled macadam top. The final grade was established with a Hadfield-Penfield grader which also proved a useful machine for pulling trucks out of the mud.

### Aggregates

The contractor purchased white limestone from a




*ROAD CONSTRUCTION NEAR SPARTA, N. J.*

*1. Keystone excavator with skimmer scoop working on subgrade. 2. C H & E Triplex pump which furnished water for the entire top. 3. Truck pulling out from subgrade of second strip over short heavy ramp. 4. Koehring 21-E paver delivering batch to the subgrade and hand finishing operations in foreground.*

quarry at Newton, N. J., and sand from the Hodgson Sand & Gravel Co. at Andover, N. J., using ten 4-batch trucks for haul. During the pouring of the first strip, the trucks drove up the subgrade, turned through a break in the forms and backed to the mixer. When the second strip was being poured, the trucks drove along the cured strip, ran off a short ramp, set against the concrete on to the subgrade and backed to the 21-E Koehring paver. A 5-bag mix, proportioned 1:1¼:3½, was used. The cement bags were thrown into the bottom of the truck before the proportioned batch was delivered to the truck at the quarry. Then the bags were cut and emptied at the mixer when the batch was dumped into the mixer skip.

Elastite expansion joints were installed every 45 feet, using a steel bulkhead slotted for the 3-foot dowels which were punched through the Elastite. Pouring was started on June 4 when 45 feet of the strip were poured and then the job had to be shut down for 4 days because of rain. Pouring was completed July 19.

Fifteen-foot hand screeds with the regulation plow handles were used and 6-foot floats for the final finish.

PERSONNEL

John F. McGreevey was his own Superintendent on this job and Frank Feussner was Construction Engineer for the New Jersey State Highway Department and Lloyd Blackford Inspector at the batch plant.

## Foundations for Chicago's Merchandise Mart to Have Ten Miles of Caissons

JOHN GRIFFITHS, builder of famous buildings, recently turned over the first spadesful of dirt to mark the formal ground-breaking ceremonies of the Chicago, Ill. Merchandise Mart. Mr. Griffiths, who is now 88 years old, was surrounded by many of Chicago's prominent business men.

The site of the Mart was formerly that of the Chicago & Northwestern Railroad Company's passenger station. The building will extend 724 feet on Kinzie Street, 577 feet on the river front and 324 feet on Wells Street. The main entrance of the building will face the river and the Drive. The Mart will have a total floor space of about 4,000,000 square feet. Ten miles of caissons will be required; there will be 450 of them, which will go down 110 feet to bedrock. It is estimated that these caissons will require 2,000,000 cubic yards of concrete.

*Left to Right, Ernest R. Graham, Architect of Merchandise Mart of Chicago; Fred Sargent, President of Chicago & North Western Railroad; John Griffiths, Builder, and James Simpson President of Marshall Field & Co.*

## An Efficient Shovel Operator an Important Factor

A high degree of efficiency in power shovel operation can only be secured through the proper coordination of several factors. The first and most apparent is the shovel operator. The ideal operator is a man gifted with quick reaction, a true eye, good judgment, great endurance and a high degree of skill and experience. He should know the possibilities, as well as limitations of the shovel and be able to maintain it in first class condition.

But it is not enough simply to secure a good operator. Except where casting is involved, the operator can dig no more material than the available equipment can haul and he can only dig when hauling units are actually in place for loading. If the supply of wagons or trucks is inadequate to handle full shovel production or if their operation is such as to interfere with the steady, methodical operation of the shovel, the fault lies with the management.

## New Method of Sprinkling Concrete for Curing

A new system of sprinkling while concrete paving is curing has been contrived and successfully used by W. F. Pigg & Sons, contractors of Denver, Colo., according to Willis Parker in a recent issue of *Western Highways Builder*. The system eliminates the necessity of hiring several men to sprinkle the pavement with hose lines, thus lowering the labor cost and reducing the replacement investment in rubber hose.

Briefly stated, the system is a series of sprinkler heads attached at intervals along a 2-inch iron pipe line. The type of sprinkler head is that used in lawns where pipes have been placed underground with the sprinkler heads flush with the surface and the entire lawn watered at one time when the water is turned on. As used in Boulder, the sprinkler heads were placed at the tips of 4-inch lengths of 1-inch pipe which in turn were attached to the water line. The intervals of sprinkler heads varied from 16 to 20 feet depending upon the length of pipe in the main pipe line. The spray produced from the sprinkler heads overlapped sufficiently so that the entire surface was wet down. Just as soon as the concrete set sufficiently to withstand the weight of the workmen and the pipe line, which was within 24 hours, the pipe line was extended upon it. A 2-inch rubber hose connected to a fire plug supplied the water to the pipe line. There were several connections made with fire plugs to insure sufficient water pressure all along the line.

The pipe line was jointed every 16 or 20 feet, so it was somewhat portable inasmuch as when one section of the pavement had been wet down sufficiently in a 10-day period, the pipe could be detached over that section and advanced to the newest section of the pavement. Thus, the pipe line followed the paver around the job. In the Boulder job, 2100 feet of pipe line were used.

One man was all that was needed to supervise the wetting which was done at intervals of two to three hours. To have accomplished the same work by the old system would have required a crew of about 12 men. Because of the fact that there were several square yards of pavement at street intersections to connect with side streets and they extended at a distance from the pipe line, it was necessary to wet down these extra spaces with the hose, but the man who superintended the pipe line was able to do that work after he turned the water into the pipe line.

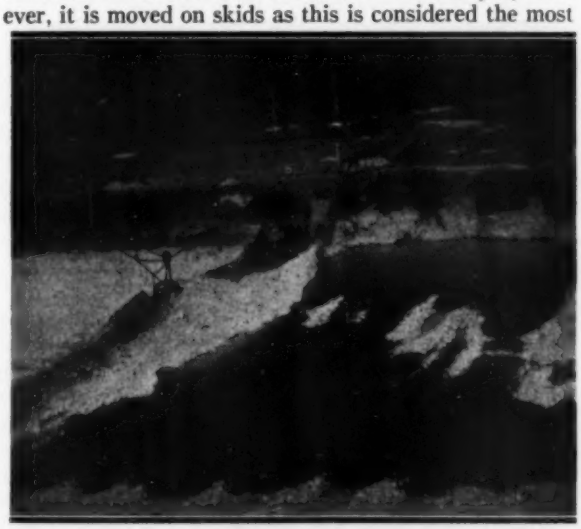
So satisfactory is this system that the firm will use it on state highway pavement in the future. While it will be impossible to obtain the water supply so conveniently as fire plugs afford, it is the intention of the contractors to pump the water required from irrigation ditches and use a Barnes Duplex pump capable of developing 90 pounds pressure at the pump.

# Large Fill Handled by Slackline Cableway

## *Movable Steel Tower on Bank of Scrivia River Makes Use of River Gravel Possible With Speed and Economy*

AT the town of Busalla in Northern Italy the Italian Railway runs along the shore of the Scrivia River where, to create the required enlarged rail facilities, it was necessary to make a large fill in the low ground between the existing rail line and the bank of the river. The fill is approximately 1,000 feet long by 330 feet wide. The contract for enlarging the Busalla yard was let to Sanguinetti & Ghersi, of Genoa. The contractors decided that the cheapest way of making the fill was to use the Scrivia River as a borrow pit as the stream bed contains a large amount of coarse gravel with a small amount of sand. A study of the situation showed that the long-range excavating ability of the slackline cableway excavator combined with its economical conveying and its ability also to elevate from the river bed to the height necessary to make the fill, made the cableway the ideal machine for the work. An order was placed with Fiorentini & Co., distributors, for a 1½-cubic-yard 800-foot span Sauerman machine, including a Sauerman 2-speed electric hoist.

Since the cableway is moved along the bank of the river as the fill progresses, it is attached at the head end to a movable, self-supporting steel tower 80 feet high. The tower, which was constructed in Italy from American design, is so built that it can be moved on car tracks or run on rails if desired. On this job, however, it is moved on skids as this is considered the most economical method for the amount of material involved.



*Digging Gravel from the Bed of the Scrivia River by Slackline Excavator*

The 2-speed electric cableway hoist is mounted at the base of the tower. The operator sits in an elevated cab just above the center of the tower. With this position the operator has a full view of the whole operation and by means of the Hobbs air control, operates the cableway with a minimum of effort.

The material being excavated is very coarse and hard packed, and consequently is hard digging, but reports indicate that the cableway is handling it satisfactorily. The machine excavates the material from the river and dumps it in the exact places on the fill where it will be available for distribution as necessary in the construction of the railroad yard. A large amount is dumped right where it will be used and requires no rehandling.

*The Fill Was Dumped Anywhere Along the Line as Needed*

As fast as the necessary amount of material is placed on the fill, the cableway is moved to the next location. The amount of moving is variable, depending upon the amount of fill material required at the various points. The shifting of the head end of the cableway is accomplished by moving the steel head tower. The lower end is moved by a Sauerman hand winch rapid shifting device.

### "Safety First" is a Necessity, Not Merely a Slogan

"SAFETY FIRST" is something more than a slogan; it is a prayer for protection from folly and carelessness; it is an invocation from men, women and children to preserve what they possess; in the knowledge that they can never be regained if lost. It is a petition to the heedless to see that their recklessness destroys no one's life, no one's limb and no one's happiness.

# 7.89 Miles of Pavement Built in 96 Working Days

## *David Schoentag & Co. Complete Job from Grading Through Pouring on Schedule*

THE Pennsylvania Department of Highways has been pushing the improvement of the Lackawanna Trail from Delaware Water Gap north and west for several years. One of the outstanding contracts on this Trail in the 1927-1928 construction season was the 7.89 miles of reinforced concrete paving south of Moscow, Pa. The contract for the complete job was let to David Schoentag & Co. of Saugerties, N. Y., in 1927.

### Design Details

The section let to Schoentag & Co. is of standard Pennsylvania design, 9-7-9 inch thickened-edge pavement, 1:2:3 mix, and reinforced with ⅝-inch bars, one along either side of the center joint and two at each outside edge. This gives unusual strength where the heaviest loads and stresses occur. Expansion joint is installed throughout the length of the pavement in the longitudinal joint and at every 150 feet of pavement across the two 9-foot strips. The Carey Elastite premoulded expansion joint used on this job was ½-inch thick.

### Construction Plant

Prior to starting the work of grading on August 1, 1927, the contractor acquired a sand pit and a quarry satisfactory to the State Department of Highways. The average haul from the sand pit to the central proportioning plant set up at the center of the job was 3 miles. The average haul from the quarry was 1½ miles. Five-ton Mack trucks and Autocars were used exclusively for hauling the sand and crushed stone. The central proportioning plant consisted of a complete Johnson 75-ton bin for sand and stone with batchers which loaded the trucks with 3 batches each. Six Autocars were used to haul the batches to the mixer.

### Preparation of Subgrade

The subgrade was chiefly good earth and rock which was graded to line with a Shawnee power grader, and a Caterpillar tractor hauling a blade grader. The subgrade was rolled with a 12-ton and the final grade with a 3-ton Buffalo-Springfield roller. The finishing of the subgrade furnished ample excellent material for the 5-foot shoulders of the completed pavement.

### Concreting Plant

Concreting was started at the south end of the project and continued for about a week when a second mixer was put on at the north end of the work and continued until work was discontinued for the winter about November 23. Two 21E Koehring pavers were used during the 1927 paving season and were replaced by a single 27E Koehring paver for 1928. Approximately 3 miles of paving of the south section and 2 miles from the north end of the project were completed before closing down in November, 1928. The remaining section of about 3 miles was poured first from the south end north, and then completed during the week of June 4, by pouring the last section from the north end of the short middle section. In this manner the work at the extreme ends was completed first and the speed of operations greatly increased during the early 1928 season with the work confined to the central section near the proportioning plant. This also cut down the number of trucks needed to supply the mixer.

Blaw-Knox 9-inch Dreadnaught steel forms with 6-inch base were used and set up sufficiently ahead of the mixer to insure a clear day's run without delays. The pavers poured the entire 18-foot pavement in one operation instead of the customary two passages, one for each strip. Two men at the mixer added the Pennsylvania-Lehigh cement to each batch as it was dumped into the mixer skip, one man attended to the barrel in which a 2 per cent solution of calcium chloride was maintained for the mixing water. This was used in lieu of other curing methods. There was one mixer man and four men spading the mix. The State specifications require a full 1¼-minute mix.

The contractor maintained a speed of 16,000 feet of two 9-foot strips per month throughout the pouring.

The concrete was finished by a Lakewood screed and belt without tamping. The State inspector tested the subgrade and the thickness of concrete practically every day with a piano wire. A length of piano wire was stretched across the road from two blocks mounted on the forms. An accurate cross section was taken from the wire and then when the concreting was completed a second section showed exactly the thickness of pavement at all points across the slab. The pavement was also tested for smoothness with a 10-foot straight edge.

### Personnel

H. R. Moffit was Division Engineer for the State during the 1927 operations. Following the reorganization of the State Department of Highways for 1928, C. H. Buckius was Division Engineer in charge of this project. W. D. Joyce was Inspector for the State and M. J. McDermott, Superintendent for David Schoentag & Co. The headquarters for the equipment used on the job were maintained near Daleville where the central proportioning plant was located and the business headquarters were at Moscow, Pa., at the north end of the job.

# The Otay Rock and Sand Plant at San Diego, Calif.

By George Adams Roalfe

*Consulting Engineer, Long Beach, Calif.*

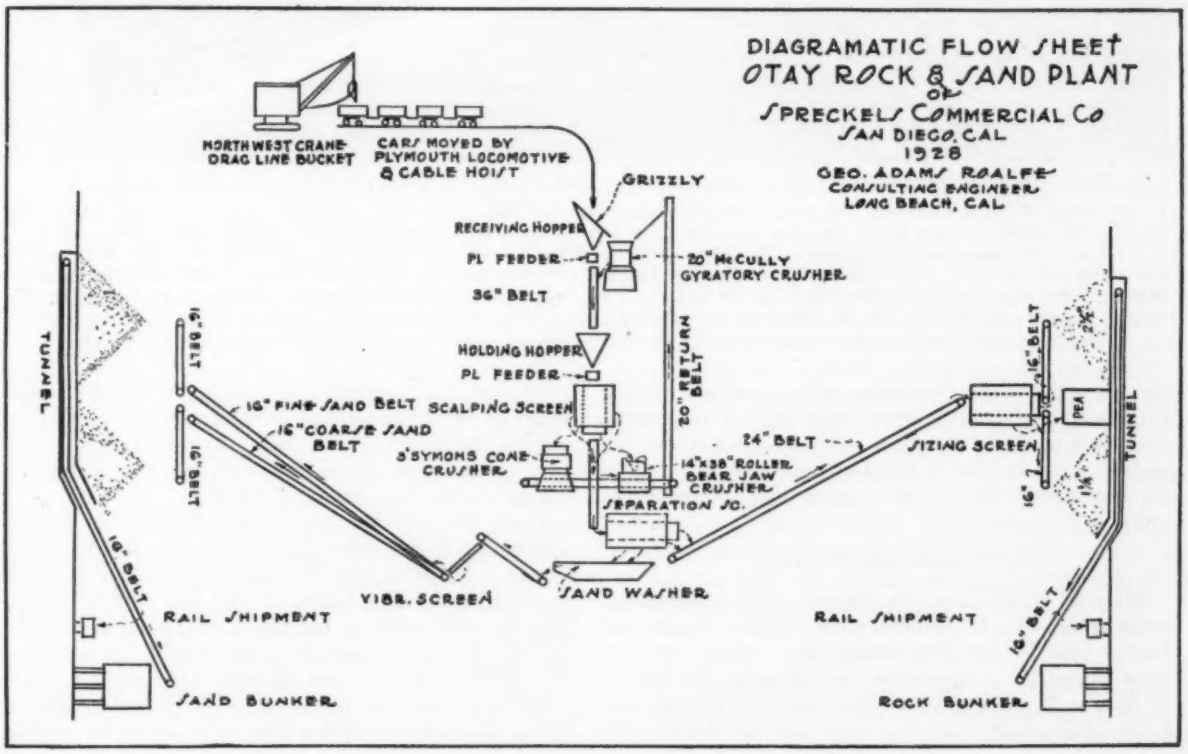
EARLY in 1927 the writer was called to San Diego to make a study of the rock and sand situation in that market for the Spreckels Commercial Co. All local deposits, whether developed or in a raw state, were studied and reported on. The Spreckels Commercial Co. just prior to this investigation had been thoroughly re-organized under the leadership of Claus Spreckels as president and J. E. Stanley as vice-president and general manager. The new company was the out-growth of the Spreckels Brothers Commercial Co., which had handled principally fuel and feed. The re-organized company continued to handle fuel and feed but expanded its activities to cover a full line of building materials. To round out its plans it was essential that an adequate supply of clean and well graded rock and sand be obtained and as a result of the investigations it was determined that the Otay River bed held the greatest possibilities both as to volume of reserves and quality of the material.

This article treats briefly of the plant constructed at the Otay deposits, this unit being only one of several operating properties owned by the company. It is believed that the plant has a number of novel features in general not encountered in rock and sand plants and it was the purpose of all concerned to eliminate as many mistakes as possible and to incorporate only the best features developed to date.

The Otay deposit controlled by the company is approximately 7 miles long and varies from 200 feet to 1,200 feet in width. The original estimate of gravel reserve would approximate 10 million tons and the experience obtained during the first year of operation indicates that this estimate is very conservative. The character of both rock and sand is extremely good, the rock being a hard porphyry and the sand being almost entirely free from mica. This characteristic of the sand has created a very heavy demand for it in this market. All rock occurs in varying sizes from pea gravel up to 20-inch boulders.

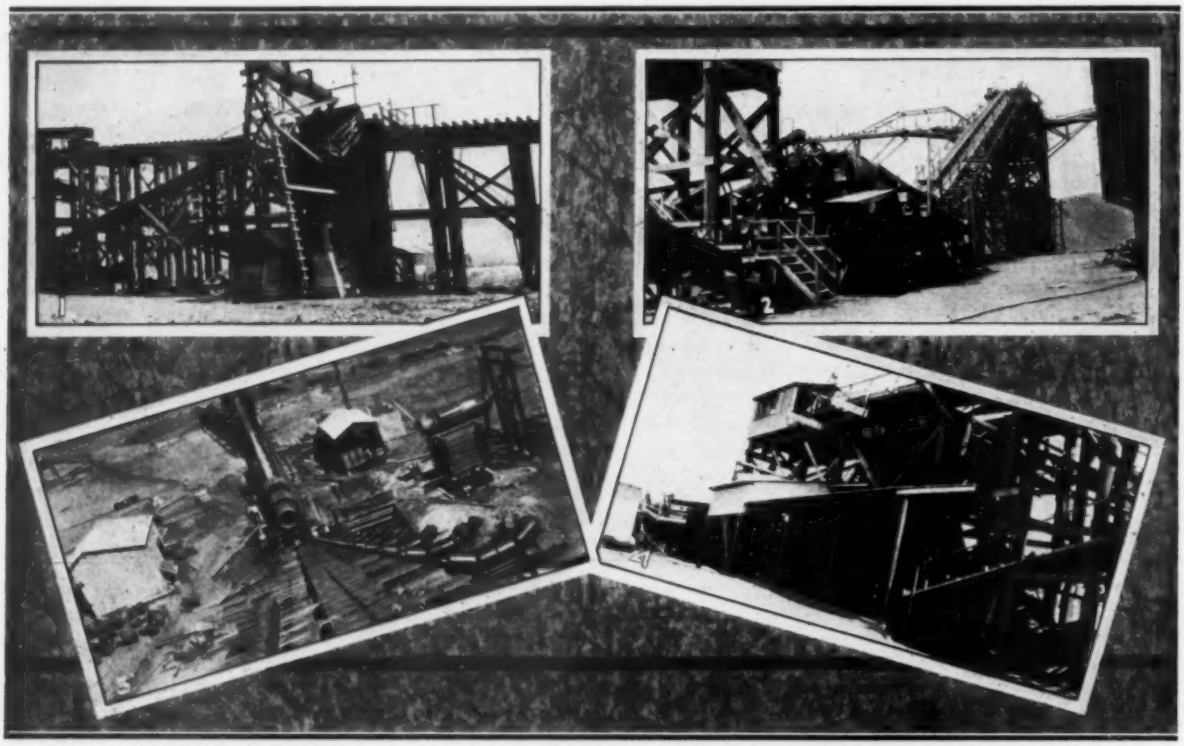
## Layout of Plant

In the design of the plant three general objectives were kept in mind: 1, to so locate all mechanical units so that they could be carried on foundations built on the ground, this plan tending toward economical construction as well as accessibility during operation and repair; 2, a straight line flow sheet which is the ideal to be striven for in any industrial plant; and 3, the



adaptability of the design for future extensions.

The first condition was met with one exception, that of the sizing screen which was located on top of a tower construction approximately 50 feet above the ground. The second condition was strictly adhered to as reference to the diagramatic flow sheet will indicate. The third condition has already proved to be true as the 20-inch McCully gyratory crusher was not installed in the initial construction as it was believed wise to investigate the deposit under actual operating conditions to determine what percentage of the rock was sufficiently large to require this unit. The operation of the plant for the first 3 months was such that a very small percentage of oversize material was encountered



*VIEWS OF THE OTAY ROCK AND SAND PLANT, TAKEN DURING CONSTRUCTION AND OPERATION*

*1. Car dump at top center with the grizzly directly below over the McCully crusher. The belt from the dump hopper and the McCully crusher is seen under the track framing. The belt from the second and third stage crushers rises from the left. 2. A portion of the hoist house is shown in the upper left, the sizing screen and washer in center and the rock belt framing and stock pile at right. Note the rock belt framing designed for a second belt. 3. View looking down the main rock 24-inch rock belt with the separation screen in the center. This photo was taken 18 days after construction started. 4. The holding hopper and hoist house are shown in the upper portion of the photograph, the separation screen is at the extreme left, the under hoist scalping screen and crushers below, and the return belt to the primary crusher at the right*

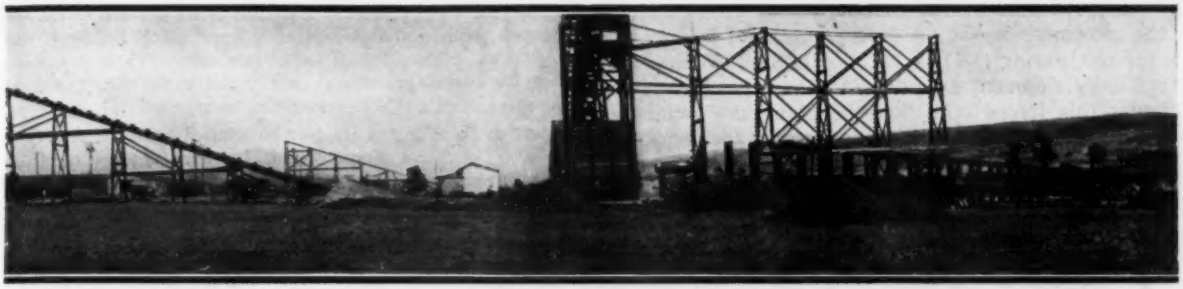
but since that time increasing percentages of boulders 12-inch and larger have been found so that in January, 1928, this unit was installed. This installation did not require any changes in existing units and only called for the installation of the crusher and its incidental belts.

### HANDLING THE MATERIAL

Material is dug from the deposits with a Northwest crane fitted with a 1¼-cublc-yard dragline bucket and loaded into 5-cubic yard dump cars. These cars are then hauled by a Plymouth locomotive to the foot of an incline in 4-car trains. The trackage arrangement at the foot of the incline is such that the loaded cars are pulled up from one track and the empties let down on a second track. The cable hoist has a capacity for two 5-cubic-yard cars at a time, and the operation as timed makes possible the continued movement of the locomotive crane as well as the hoist.

The cars are pulled up the incline to a receiving hopper fitted with a grizzly set at 5-inch spacing. Material under 5-inch passes down through the grizzly into a storage bin and is fed out by means of a plate feeder onto a 36-inch belt conveyor. The rejects of the grizzly are fed into the 20-inch McCully gyratory crusher and its product in turn fed back on to the 36-inch conveyor belt mentioned above. The method of loading the 36-inch conveyor belt is such that the sand and finer material is loaded first and crushed material from the gyratory crusher on top greatly reducing the wear on the belt. The 36-inch conveyor belt carries the mixed material up into a holding hopper having a capacity of 75 tons.

From the holding hopper the material is fed by means of a plate feeder into a double jacketed scalping screen. Material passing the outer jacket contains material under 2½ inches in size and carries directly into the other units of the plant. Material passing the inside jacket and rejected by the outside jacket is fed by gravity into a 3-foot Symons cone crusher. The material rejected by the inside jacket is fed by gravity into a 14- x 38-inch Roller Bear jaw crusher by gravity.



*A Panorama View of the Otay Plant Looking East from the Rock End Three Weeks After Starting Construction*

### CONTROL OF SIZE OF STONE

The product of these last two named crushers is conveyed by two belts to the gyratory through a circuit of the crushing units. It is evident that by the proper setting of the second and third stage crushers the percentage of various sizes of rock into the plant may be conveniently regulated. The material passing through the outside jacket of the scalping screen is conveyed on a belt conveyor to a double jacketed separation screen. At this point the rock and sand operations are separated. The separation screen was provided with two jackets to relieve the outer jacket from excessive loads and aid in a more perfect separation of the sand from the rock. Considerable water is used at this stage serving the dual purpose of washing the rock and aiding in washing the sand through the screen into a duplex rake washer below.

### HANDLING THE ROCK

Reference to the diagramatic flow sheet shows that the product passing through the inner jacket and dejected by the outer jacket of the separation screen is first loaded on the 24-inch belt conveyor. The larger material is not discharged on to this belt until after this first load is well distributed. This serves two purposes. It enables a heavier loading of the belt and, by placing the smaller material on the belt first, it is protected from excessive wear from the larger sizes of rock. The 24-inch belt conveyor discharges into a double jacketed sizing screen where the aggregate is divided into three sizes; namely, 2½-inch rock, 1¼-inch rock and pea gravel. Sufficient screen area has been provided so that the 2½-inch rock contains a very small percentage of a particle smaller than 1¼-inch and similarly the 1¼-inch rock contains a very limited percentage of pea gravel. The sizing screen, which discharges three sizes of materials, was provided with two 16-inch belt conveyor extensions. The pea gravel passing through the outer jacket is collected in a bunker constructed by surrounding the supporting frame work with timber walls and the 2½-inch and 1¼-inch rock are discharged over the end of the belt conveyor extensions into stock piles on the ground. Under the storage so provided and extending a sufficient length to recover the bulk of the stock piles is constructed a concrete tunnel 6 feet wide and 7 feet high. The top of the tunnel is provided with gates at intervals of about 8 feet by which the 16-inch belt conveyor extending the full length of the tunnel and up an incline frame work to the rock bunker may be loaded. This belt is also adapted to loading railway cars by the insertion of a stationary tripper. At present the company is engaged in the construction of approximately 4½ miles of spur track to connect this plant with the San Diego & Arizona Railway, this having been a portion of the plan held in mind at the time the plant was constructed. The rock bunker has a capacity of 1000 tons, and is divided into four pockets, three of which are used for holding stores of the three sizes of rock carried and the fourth to hold any particular mixture which can readily be blended on the belt by drawing the proper amounts of each size from the stock piles.

A considerable portion of the tonnage moved from this plant is for use on paving jobs and, as is the practice in Southern California, course aggregates for paving work, particularly Portland cement concrete, are delivered in batchers usually of five to seven sacks. The company is using a compartment batcher which volumetrically measures the proper amount of two or more sizes at a single operation. This batcher was developed for Graham Bros., Inc., of Long Beach, who hold the patents on the device. This method of proportioning has resulted in the delivery of rock mixes of extreme uniformity and its control makes possible a very low void content. Under the highly competitive market conditions that exist in the San Diego market this fact has proved to be highly beneficial in stimulating sales, as it produces greater volumes of good concrete for each sack of cement used. Material not delivered in batches can be readily graded on the belt in the tunnel.

### SAND PRODUCTION

In the sand portion of the plant, material that has been discharged from the separation screen together with the wash water falls into the sand washer, where it is thoroughly scrubbed and the product is carried up on a 20-inch belt conveyor to a vibrating screen where the sand is separated into two sizes. These separate sands are, in turn, conveyed up two parallel 16-inch belt conveyors to the top of a tower approximately 50 inches above the ground and then on two cantilever extensions for stock piling. As in the case of the rock storage the sand storage has a concrete tunnel, by which the sand stores can be removed to the sand bunker or for shipment by cars.

### PRODUCTION

The construction on this plant was started on July 5, 1927, and it was placed in full operation by August 15, 1927. At that time it was considered that a daily

capacity of 1000 tons of rock and sand would care for the company's needs. Although the plant is only one year old, during the first six months of 1928 the average daily shipment exceeded 1800 tons per day. Even under this forced operation the plant has functioned as smoothly as could be expected from a rock and sand operation, and there have been no serious operating difficulties encountered.

## Winter Construction Pays

THAT there are definite direct savings through winter construction, particularly in the building industry, and a large number of interest savings is the essence of a bulletin issued by B. H. Wait, Chairman of the Committee on Winter Construction of the New York Building Congress. Mr. Wait states that records of winter construction prove that labor productivity is greater and labor costs less per unit of construction through the winter months. This, together with other advantages to be secured in the purchase of materials and in earlier returns on investments, make winter construction a good business proposition. The direct additional costs due to construction carried on in cold weather are but a small percentage of the total cost of the building. Such direct winter costs are more than offset by savings in other ways. These conditions extend down the scale at least to operations as low as $100,000.

The indirect savings which more than counterbalance winter costs include the following:

First: Labor bonuses are eliminated.

Second: Labor turnover is reduced.

Third: The spread in overhead expense of contractors throughout the year reduces organization and equipment costs.

Fourth: The tendency of contractors to lower their margin of profit with the idea in mind of securing sufficient work to keep their organization intact during winter months.

Fifth: Seasonal discounts on materials.

Sixth: Seasonal rates by transportation companies in order to relieve the congested periods.

Seventh: Saving of interest and taxes on investment lying idle.

Eighth: Earlier return on investment.

Emphasizing the stimulating effect of all year building on allied industries, particularly in the building materials field, and to the trade in general, Mr. Wait points out that healthy activity in the second largest industry in this country is bound to have its influence on all business. The even spread of building throughout the year is a large factor in general economic stability. The peaks and valleys of construction will be leveled to the point approaching real stability when the building public through owners and architects fully understand the possibilities in winter building both for themselves and the industry.

## Valuable Steel Construction Literature Available for Contractors

THE American Institute of Steel Construction, Inc., 285 Madison Avenue, New York, has issued in reprint form two valuable contributions to the literature on steel construction. The first, "Earthquake-Resistance Structures" by Wendell M. Butts, Civil Engineer, San Diego, Calif., treats of the effects of earthquakes on different types and heights of structures and shows those best able to withstand the attacks of tremblors. The second paper is entitled "Endurance and Beauty in Steel Bridges," by Charles Evan Fowler, Consulting Engineer. This paper takes up the history of bridges from the stone slab girders of the Egyptians through the various types of structures to the different forms of steel bridges used today. The paper is well illustrated and makes instructive reading.

Four other pamphlets, smaller in size, are devoted to the use of steel in hotels, industrial buildings, office buildings and steel as a definite attribute to building value. These pamphlets show the advantages of steel construction in the ability to make alterations and additions to existing structures.

Any of these pamphlets may be secured from the American Institute of Steel Construction, Inc., by readers of CONTRACTORS AND ENGINEERS MONTHLY, by mentioning this magazine.

## New Skyscrapers in Philadelphia Use Concrete Units

FOR what is believed to be the first time in the history of the building industry concrete masonry units are being used throughout the entire construction of at least two skyscrapers. The structures in which these units are being adopted are the Integrity Trust Building and the Bouvier Apartments in Philadelphia.

The Integrity Trust Building will, when completed, be 25 stories high and contain 350,000 cinder concrete units in addition to 1,000,000 concrete brick.

The Bouvier apartment building which is to be a 23 story structure will have cinder concrete masonry units for back up and fire proofing. Approximately 165,000 masonry units and 1,150,000 concrete brick will be used in the exterior walls.

## Cutting 12 x 12 Fir Piles 20 Feet Under Water

GOVERNMENT specifications required that the Greiling Engineering Co., Green Bay, Wis., on a project at Frankfort, Mich., "saw off squarely and not vary more than ½ inch above or below the designated level," one hundred square pilings of 12 x 12-inch fir. E. R. Luidtke, Superintendent for the Greiling Engineering Co., reports doing this work using two divers and a Wolf portable air-driven timber sawing machine. The accompanying illustration shows a diving scow with the diver tenders and the pike pole man recovering the end of a square piling which was cut off 20 feet below the surface of the water. The saw was in operation as is indicated by the foaming water due to the exhaust of the air-driven motor.

Mr. Luidtke reports that the upkeep of the saw chains consisted of a charge of $3 for filing for every one hundred fir timbers cut and the replacement of one broken tooth at a cost of $1.50. The only other upkeep consisted of cleaning the air motor once and the cost of oil and grease. It was found necessary to inject alcohol into the air line to keep the air motor from freezing. One hundred square pilings were cut in 6 hours, reducing the time of cutting to about one-sixth that for the usual method.

*Cutting 12 x 12 Fir Piles 20 Feet Under Water With a Wolf Air-Driven Timber Sawing Machine*

# Safety in Steel Erection

By R. B. Thomas

*Counsel, Structural Steel Board of Trade, Inc., New York*

THE safety engineer who has the job of cutting down the accident record of a large construction project is, indeed, in an unfortunate position, for he not only has plenty of hard work but at times it would seem that every man's hand is against him. By its very nature construction work is dangerous and economy of cost demands speed in building. The owner wants the building completed before the next renting season. The contractor wants to keep the cost at a minimum and also wishes to satisfy the owner. The men resent interference and what seem to them unnecessary precautions. The constant labor turnover makes safety education difficult.

Again, the contractor is not selling a staple commodity at a definite market price. If, because of expensive safety measures peculiar to his own organization, and not general in the trade, his costs rise, he is placed in a bad competitive position. His instincts are all on the saving side, particularly after losing a few jobs to a lower bidder. The more obvious and important safety requirements must be a matter of law with adequate inspection, but the better way for the construction industry would be for the architects and engineers to write into the specifications, the precautions that must be taken on the particular operation. In that event all the bidders are on the same basis and the cost element disappears.

Steel erection is not the safest work on the building, because of its very nature, and the industry itself is most anxious to reduce accidents. Our insurance costs are very high and we would welcome the saving, aside from the humanitarian view. The members of the New York Structural Steel Board of Trade, with which I am connected, believe and hope that they can reduce the number and severity of their accidents. But we are making haste slowly until we can find out just what needs to be done. The first of this year we started to receive duplicate reports of all accidents from our members. We hope that at the end of this year we may have sufficient data as to the causes of our accidents, that we may figure ways and means of preventing a large percentage. It is possible, from the reports already received, to draw some conclusions which may be helpful.

### The Infrequent Serious Accident

Our most bothersome types of cases are those which are constantly with us, not the ones which are almost in the nature of catastrophes, in which more than one are hurt. In this latter type the causes can nearly always be traced to the carelessness or neglect of some man, or more frequently, the foreman or pusher.

For instance, in one case, in order to put a strain on the line, the men had passed a hoisting cable that was being wound onto the drum of a hoisting engine, around the wooden foot block of the derrick, on top of which two men were rigging up. The line became entangled, the engineer kept the drums moving and the foot block was pulled loose, with the consequent fall of the derrick. Again, one erection gang was racing another, they had just raised their derrick to another floor, and were lifting the first load. Someone had neglected to see that there was no slack in the lashing holding the derrick footblock to the structure. The foot of the derrick moved, snapped the lashing, and the whole thing fell into the building. The handling of heavy erection equipment requires meticulous care on the part of those in charge.

However, such cases as have been presented are few and far between and their number, as compared with the increasing tonnage of steel erected, is on the decrease. The other classes of cases, minor in severity but major in cost and suffering, are always present. While it is necessary to prevent the serious wrecks, if possible, if active steps are taken to cut down the other risks these infrequent serious accidents will decrease in consequence.

### Rational Rules for Steel Erection

A few simple and necessary rules to be followed in steel erection on buildings are:

1. Forbid riding on loads and cables on the outside of buildings.

There is no necessity for this practice and it is only

## Another Popular Fallacy Nailed

*The steel erection fraternity is popularly supposed to be the bad boy of the building industry. The lay public has the idea, fostered somewhat by the press, that a New York skyscraper "costs a man a floor." Too many men are killed in this work, but the actual facts make the popular idea ridiculous. During the calendar year of* 1926, 27 *structural steel workers met their deaths from accidents in the course of their employment, in the state of New York. In that year considerably more than* 500,000 *tons of structural steel went into buildings in this state. Roughly, that means that one man was killed for every* 20 *apartment houses, say* 15 *stories in height and* 100x100 *feet in ground area. During the same year* 15 *were killed in New Jersey. There the tonnage erected was somewhat less, but the proportion was probably not much different. This information is from the respective State Departments of Labor and is surely authentic.*

undertaken by the men in a spirit of bravado and to save a tiresome ladder climb. A sudden change in the speed of the hoist or the swaying of the load against the building may loosen the man's hold and he nearly always falls to his death.

2. Keep up a constant inspection of hoisting equipment.

3. Check carefully the possibility of overloading the derrick.

Erection gangs often save time by taking up more steel in one load than can safely be lifted by the equipment provided. The margin of safety should be large, for a jerk on the cable when "booming up" or through lack of smooth operation on the part of the engineer multiplies the strain on the cable many times. This is particularly to be avoided when the angle between the mast and the boom of the derrick becomes a large one.

4. If at all possible, do not permit the throwing of rivets toward the outside of the building.

It is usually not necessary to throw toward the outside and if passed inward, a missed rivet has some chance of being stopped by a floor. On the outside it is almost sure to carom down into the street, where if it injures no one, it may do damage to property or cause a fire.

5. Provide cone-shaped cans for catching rivets.

These are not expensive and are easy to handle. Rivets often bounce out of flat bottomed pails, which are not strong enough for the purpose in any event. After some use the rivet is liable to go through and injure the catcher.

6. Insist that burners wear goggles.

7. Provide tote boxes for the bolters up and see that they use them.

Many injuries are caused by loose bolts and rivets lying around the building and which fall down below.

8. Be sure that the erection floor is clear of any loose objects before the planks are raised to the next level.

It is easy to clean a plank by turning it up on edge but that doesn't protect those below.

### ACCIDENTS FROM FALLING OBJECTS

We find that about one-third of all accidents come from "falling objects;" not heavy pieces of material but rivets, bolts and tools. About one-half of those or one-sixth of the total are injuries to men of other trades on the same building who are working below the ironworker. Directly below, on the usual operation, are the carpenters building forms and the concrete laborers putting in the concrete floor arches. If these men were afforded some protection the risk would most certainly be lessened.

The erection gang raises the beams and columns, sets them and bolts them in place. Then along comes the riveter, who takes out the bolts and replaces them with rivets. The floor on which the erection is going on is always planked over, but the riveters are usually at work on the two floors directly below this and immediately above the concrete men. It would seem that if an extra floor of plank, or some other protection, were interposed just below the riveters, a number of these distressing head and back injuries would be eliminated. Unfortunately we cannot do this in New York because of statutory requirements that compel the concrete arches to follow the steel erection closely. This particular law should be changed so that the proper protection could be afforded, but even in that event it would be necessary to have the requirement written into the job specifications so that the careless and unscrupulous contractor would not reap the benefit of the lower cost. The erection floor plank are comparatively easy to handle, as they are lifted to new levels through open space, but to provide an extra floor of planking below would prove somewhat more expensive. Perhaps if the arch requirements were not so stringent it would be possible to leave this extra floor in place for some time, and it would only have to be handled a few times during the whole building operation. In that event the concrete men would not be on the job so soon. Falling bolts cannot injure men who are not there.

### STEEL NOT EASY TO HANDLE

The heavy character of our material makes it difficult to handle and we have a number of cases in which men suffer contusions and bruises to their hands and feet. A beam rolls over or a connector pinches his fingers between a beam and a column. These account for one-fifth of all our accidents. Strains from lifting cause another 2.8 per cent. Apparently there are no safeguards for this class of cases except the education of the worker and competent and careful supervision.

### PROTECTION OF THE EYES

"Foreign matter in the eyes" is the cause of 13.6 per cent. The stronger breezes up high on the skyscrapers blow around a lot of dirt and dust. Some eye injuries come from steel chips and others from sparks from forges and burning torches. Obviously the burners wear goggles during the actual burning operation, during which they are generally settled in a stable position. For the other men the cure might be worse than the disease, for the man who walks a beam at a dizzy height needs his full range of vision.

### FALLS

"Falls of person" cause 11.1 per cent of all the accidents, but peculiarly the ironworker seems to be careful when he is in a dangerous position. More than one-half of these falls occur on the level. I know of an authentic case in which an ironworker who had walked beams for 20 years, slipped on the curb and gave himself a bad spinal injury. Sometimes our man falls into an unauthorized opening or one that is improperly protected. This would appear to be a frequent cause of fatal accidents. Proper protection of openings is one of the essentials of safe building construction.

### INJURIES BY EQUIPMENT

Again, our heavy material is the cause of another class of accidents. It must be lifted under power and at the end of cables sometimes many stories in length. The swaying and swinging of loads and cables cause 6.3 per cent of our cases. These can only be cut down by extreme care and watchfulness on the part of the men.

In 2.9 per cent of our cases the men injured themselves with their own tools. In 1.8 per cent they were injured by tools wielded by another. Various miscellaneous causes account for another 1 per cent. Failure of equipment causes only 1.7 per cent.

In 9.5 per cent of our cases our men are injured

n-847-L

# In Public Life

**County Commissioners of Kewaunee County, Wisconsin, have five Waukesha Portable Power Units, some of which have seen six years service in road maintenance. Operating at wide open throttle on rock crushers is only possible with engines designed solely for that kind of a job.**

*Waukesha Power was chosen by the Russell Grader Company for the equipment owned by the Ohio State Highway Commission because of such records. Write for Bulletin No. 556.*

N-869-L

*INDUSTRIAL EQUIPMENT DIVISION*

**WAUKESHA MOTOR COMPANY**

**Waukesha** **Wisconsin**

| New York | Tulsa | Houston | San Francisco |
|---|---|---|---|
| *8 W. 40th St.* | *C. F. Camp Co.* | *Portable Rig Co.* | *C. A. Watts* |

*Exclusive Builders of Heavy Duty Gasoline Engines for Over Twenty Years*

through the fault of employees of other contractors, 2.8 per cent from "falling objects" and 6.7 per cent from stepping on nails protruding from lumber lying around the building. The latter is one of the greatest causes of injuries in building work that can readily be eliminated. If the concrete form lumber is taken care of as soon as it is torn down and either piled or nails removed, a lot of ironworkers would be happier. Many is the foot infection that prevents a man from earning his livelihood for a long period.

### WELDING MAY REDUCE ACCIDENTS

Perhaps the welding of structural steel will become an actuality in a few years and we will have fewer rivets to throw and drop, and no one would be more thankful than the steel contractor if the accidents that could be attributed to him would be materially reduced as a result. I am sure that the construction industry may rest assured that the steel erecting contractors are more than anxious to cooperate with the rest of the trades to the end that buildings may be put up with a maximum of safety.

---

ACKNOWLEDGMENT.—From a paper read before the Construction Section, National Safety Council.

## Truck Speed on Grading Operations Is Governed by Road Conditions

THE performance of trucks is governed largely by the supporting power of the ground at the shovel and at a dump on grading operations. Generally the traveled way between the shovel and the dump is more compact and easier to maintain. The exact soil conditions which will be encountered at the bottom of the deep cut is naturally a matter of conjecture until the work is well under way. With this uncertainty, it seems that more stress could well be placed on the necessity of having all trucks equipped with the most favorable type of tires. Observations made by the Division of Management, U. S. Bureau of Public Roads, on a number of projects on which trucks were used indicate that several which were handled at little or no profit could have been converted into profitable undertakings by merely adjusting this one item of equipment. Such a change would have enabled the trucks not only to operate over the soft ground, but would also have reduced the turning time and materially increased the operating speed, an important item on long haul work.

In practice the working speed seldom, if ever, reaches the rated speed of a truck. No job has yet been found where the trucks were consistently working at anywhere near their rated full load speeds. The job speed appears to be governed partially by the load, but more definitely by the road conditions. Bad going and overloaded trucks are the rule. Overloading appears to be due in part to attempts to counteract the effect of low speed by carrying larger loads. Generally this makes road conditions still worse, necessitating even lower speeds and finally as the roads become still worse, smaller loads at very low speeds. It appears that this problem can best be solved by adequate tire equipment, proper loads and reasonable attention to maintenance of the roads. This would more often permit a normal operating speed.

Tire equipment suited to road conditions on highway construction will considerably simplify keeping the traveled way in good condition. The matter should not, however, rest here. When the hauling must be done over a yielding surface ruts are inevitable unless a blade grader or drag is kept at work most of the time. Filling depressions before they become large will generally keep the surface in reasonably good condition except in very wet or very dry weather. In dry weather, bad places can usually be patched if an occasional load of moist clay be placed so that it can be bladed gradually into the ruts. The tendency is to put off blading until the ruts become so deep that they obviously hinder the trucks. When this point has been reached, it is difficult, if not impossible, to correct it. There is some danger in filling very deep ruts with a drag or grader because the material is seldom stable until it has been driven over a good many times. The worst holes are hidden so that there is more danger of damaging the trucks immediately after the ruts are filled than there was before. Maintenance, to be effective, must be used as a preventive rather than as a cure. Next to the use of suitable tires, continuous maintenance is probably the most important item in securing a profitable output where trucks are used.

Road conditions between the shovel and the dump may often be improved by more careful work by the shovel operator and grade foreman. Occasionally a foreman will be found who sets grade targets at the height of the operator's eye, so that the operator can tell at all times just how closely he is cutting to grade and can have the floor of the cut behind him reasonably smooth and close to grade. Excavation conducted in this manner leaves a much better surface for vehicles to travel over and enables a greater speed to be maintained.

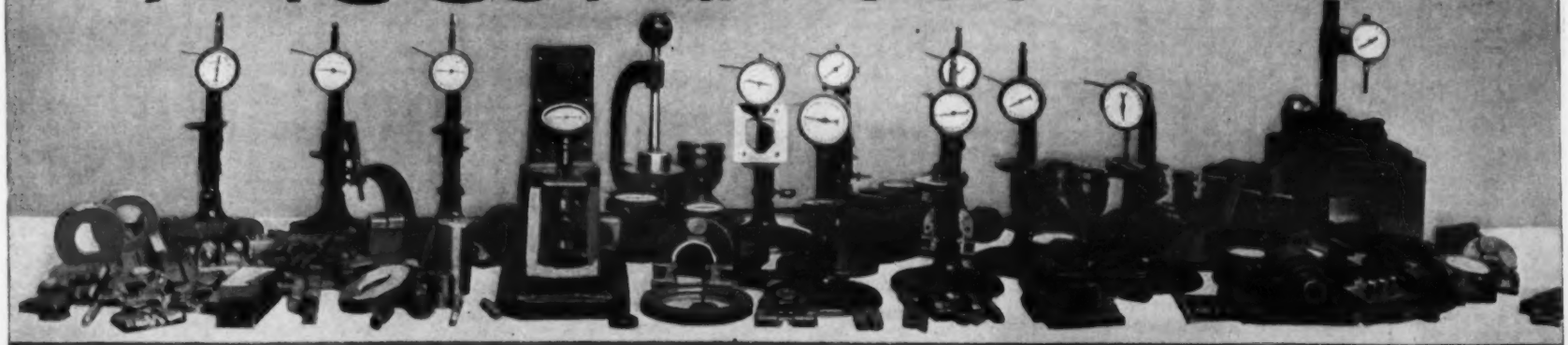
## Contracts Awarded for Toll Bridges in Missouri and Kentucky

THE National Toll Bridge Co., has announced the award of contracts for construction work on three bridges. The contract for the substructure on the Hermann bridge over the Missouri River at Hermann, Mo., was awarded to the Foundation Co., of New York. The substructure of this bridge is to be completed April 15, 1929, and the entire bridge finished by September 15, 1929. The contract for the Madison bridge over the Ohio River between Madison, Ind., and Milton, Ky., has been awarded to the Vang Construction Co., Pittsburgh. The substructure of the Madison bridge is to be ready by July 15, 1929, with the completion of the entire structure set for January 1, 1930. The contract for the Independence bridge to be erected across the Missouri River near Kansas City was awarded to the Union Bridge and Construction Co., of Kansas City, Mo. The substructure is to be completed by May 15 and the schedule calls for the completion of the entire bridge by October, 1929.

---

*A Bucyrus-Erie Shovel Dumping into a Hug Truck on One of the Most Difficult Stretches of the Rainier National Park, Washington, Highway, Now Being Improved. The Highway Makes a Rise of 3,500 Feet in 20 Miles. Many of the Places in the Road Are Blasted from Solid Rock. In Many Places It Is Necessary to Build Up Masonry Walls to Keep the Road Bed in Place*

# The Story of ACCURACY in Neptune-built Meters



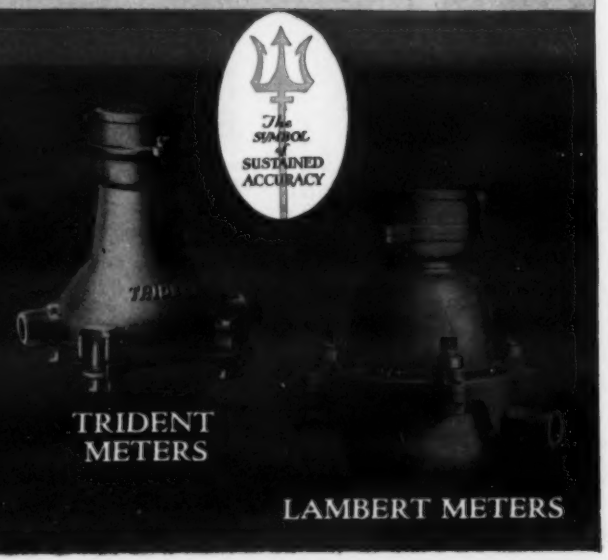
CHAPTER FIVE OF A SERIES

## These check Gear Trains and Registers!

**Think! The *gear-train* alone is gauged some seventy-five times during the production of its parts, and *all* interchangeable parts are again 100% inspected finally, before assembling! And every detail, from the finest wheel on the *register*, is so gauged and inspected in the same way . . . eternal Neptune accuracy in manufacture that spells sustained accuracy in water registration.**

***Of Trident and Lambert meters, [The Cash Registers of the Water Works Field] well over 4,500,000 made and sold the world over.***

**NEPTUNE METER COMPANY**
**THOMSON METER CORP., 50 East 42nd Street NEW YORK CITY**



# Who's Who in Construction

## *A Series of Reports from Active Contractors Published Monthly*

BUS. VOL.—ANNUAL VOLUME OF CONTRACTS
A—Over $5,000,000
B—Between 1,000,000 and $5,000,000
C—Between $500,000 and $1,000,000
D—Between $250,000 and $500,000
E—Under $250,000

**The Terry & Tench Co., Inc., New York,** Grand Central Terminal. Organized June, 1903. Bus. vol. D. This firm was organized by Edward F. Terry and Frederick Tench after the original partnership in 1895. Officers: Frederick Tench, President; A. P. Tessier, Secretary and Treasurer. Major contracts: erection of steel in ten sections of the New York subway.

*Photo by Blank & Stoller*

*Frederick Tench*

**E. Elford & Son, Columbus, Ohio,** 555 Park Street South. Organized 1926. Bus. vol. C. This business was operated as an individual under E. Elford for fifteen years, and has been operating as partnership for the last two years. Partners: E. Elford and H. Elford. Major contracts: 1924, Austin Hall, Ohio Wesleyan University, Delaware, Ohio (girl's dormitory); 1926, Lanman Building, Columbus, Ohio (office building), and Columbus Packing Co., Columbus, Ohio (abbattoir and cold storage building); 1927, Harding Memorial, Marion, Ohio, and Chemistry Building, Ohio State University, Columbus, Ohio. Member: A. G. C. of A.

**C. H. Kearns, Fairfield, Iowa.** Organized 1918. Bus. vol. E. Under the name of Spalding & Kearns, a general local concrete construction business was conducted from 1906 to 1918. Owner: C. H. Kearns. Major contracts: 1925, box culverts for Jefferson County; 1926, box culverts for Jefferson County and State Highway Commission; 1927, box culverts for State Highway Commission, and brick pavements on East Burlington Street, Fairfield, Iowa. Member: Central Branch of A. G. C. of A.

**L. E. Whitham & Co., Wichita Falls, Texas,** 1901 Austin Street. Branch offices: Santa Fe, N. Mex. and San Angelo, Texas. Organized 1919. Bus. vol. C. Officers: L. E. Whitham, owner. Major contracts: approximately 1,000,000 square yards of concrete paving in Wichita Falls and Wichita County; 60,000 square yards of concrete paving in Santa Fe, N. Mex.; 400,000 square yards of concrete paving in San Angelo, Texas. Member: Texas Highway Branch of A. G. C. of A.

**Rago Bros., Inc., Syracuse, N. Y.,** 320 Union Building. Organized January, 1926. Bus. vol. 3. This firm is composed of four brothers with many years experience in the paving business, who were formerly in the employ of the old Warner-Quinlan Asphalt Co. Officers: E. J. Rago, President; F. A. Rago, Vice-president; A. C. Rago, Treasurer; Louis Rago, Secretary. Major contracts: 228,000 square yards of sheet asphalt paving on forty principal streets in Syracuse. Member: New York State Highway Chapter of the A. G. C. of A.

**Jenks & Venton Construction Co., Inc., Syracuse, N. Y.,** 1612 Burnet Avenue. Organized April, 1919. Bus. vol. D. Officers: Giles M. Jenks, President; Harry B. Jenks, Secretary and Treasurer. Major contracts: 1925, Nottingham Junior High School; 1926, Salem Hyde School; 1927, Elmwood School and Theo. Roberts School; 1928, Pere Lemoyne School, all in Syracuse, N. Y. Member: Syracuse Builders Association.

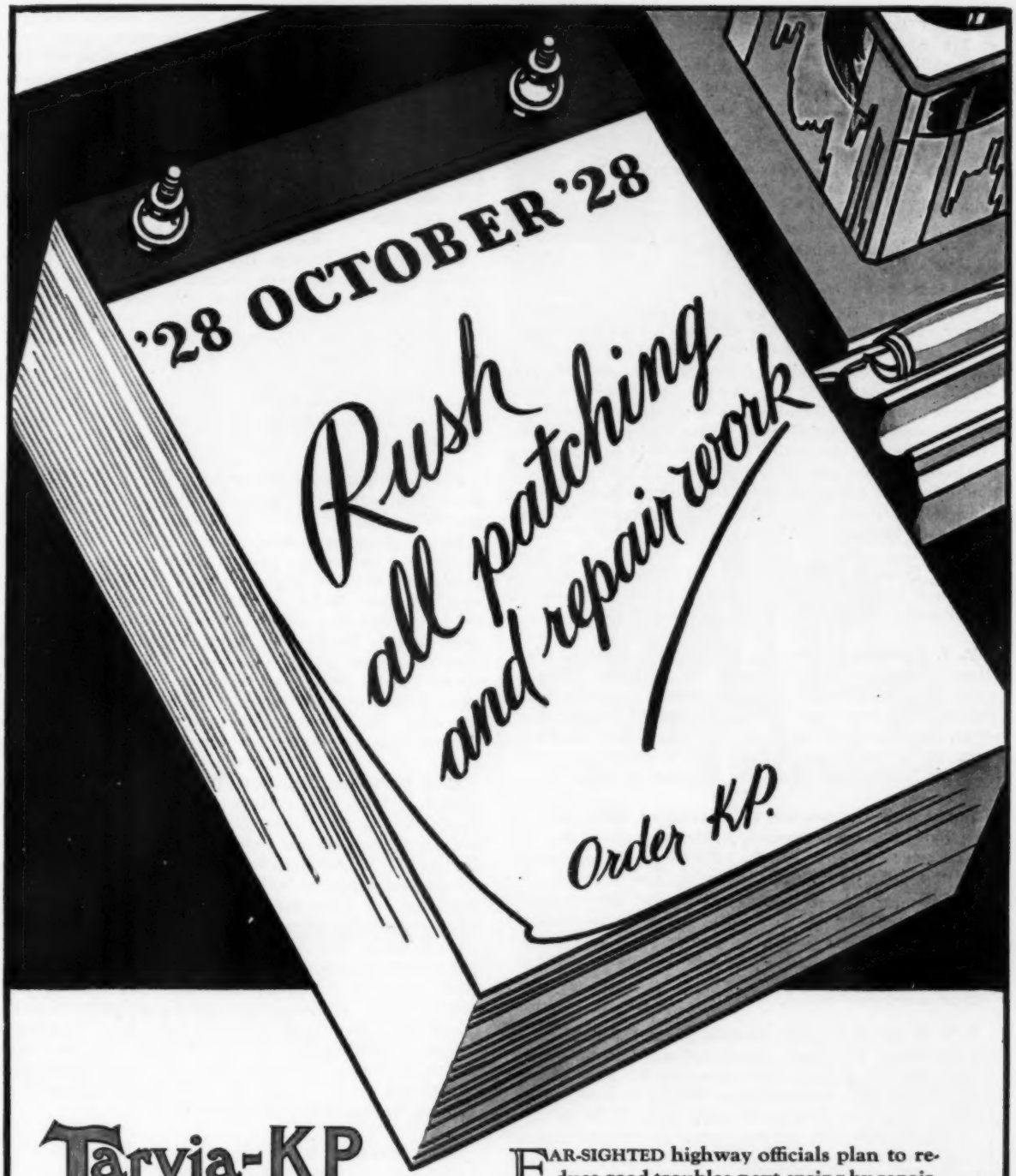
**Butz & Clader Co., Allentown, Pa.,** 523 Hamilton Street. Organized August, 1922. Bus. vol. D. This business was conducted under the name of Butz & Clader from 1910 to 1922, when Mr. Clader died. The Clader interests were purchased by Solomon Butz, who had been the junior partner, who took into the business as a partner his son, Alvin H. Butz. Major contracts: Wilson Borough High School, Wilson Borough, Easton, Pa.; Bernardsville High School, Bernardsville, N. J.; Moose Lodge Building, Easton, Pa.; B. P. O. E. Building, East Stroudsburg, Pa.; Moose Lodge Building, Tamauqua, Pa.; Sheridan School Building, Allentown, Pa.; Nazareth National Bank, Nazareth, Pa.; and Patients' Building, Allentown Hospital. Member: Associated Pennsylvania Constructors, and Lehigh Building Chapter.

**Walter S. Rae, Pittsburgh, Pa.,** 439 Oliver Building. Branch office: 302 Coal Exchange Building, Wilkes-Barre, Pa. Organized 1910. Officers: Walter S. Rae, owner. Major contracts: 1925, Petroleum Street Bridge, Oil City, Pa., and Ices Ferry Bridge, Morgantown, W. Va.; 1926, Eden Park Reservoir, Cincinnati, Ohio, and Penna. R. R. Bridges at Altoona, Pa.; 1927, Market Street Bridge, Wilkes-Barre, Pa. Member: Associated Pennsylvania Constructors, and A. G. C. of A.

**W. L. Yokom, Dubuque, Iowa,** 730 Main Street. Organized July 1, 1922. Bus. vol. D. After having been associated with one of the largest contractors in Chicago, and later with one of the largest in the Middle West, Mr. Yokom started in business in Dubuque, doing institutional and industrial work. Officers: W. L. Yokom, owner. Major contracts: 1925, Nurses Home at Finley Hospital, Dubuque, and library building for Frances Shimer School, Mt. Carroll, Ill.; 1926, Sawyer Hall for Frances Shimer School, Mt. Carroll; 1927, women's dormitory for Augustana College, Rock Island, Ill., office and warehouse for International Harvester Co., Dubuque, plant for Maizwood Products Corp., Dubuque, and school for Holy Trinity Church, Protivin, Iowa; 1928, Grandview Ave. M. E. Church, Dubuque. Member: on Board of Directors of Master Builders Association of Iowa.

*W. L. Yokom*

**F. W. & J. J. Crouch, Rochester, N. Y.,** 84 Bronson Avenue. Organized 1900. Bus. vol. D. Major contracts: 1926, Parts 1 and 2 of Scottsville Road completed; Haskenville-Fremont Highway; 1927, Honeoye Hemlock Highway—all state highway projects.




# Tarvia-KP
FOR COLD PATCHING

The Barrett Company

| | | | |
|---|---|---|---|
| New York | Chicago | Philadelphia | Boston |
| St. Louis | Cleveland | Cincinnati | Kansas City |
| Detroit | Salt Lake City | Birmingham | Lebanon |
| Minneapolis | Milwaukee | Bethlehem | Columbus |
| Youngstown | Syracuse | Toledo | Rochester |
| Baltimore | Providence | | Buffalo |

In Canada:
THE BARRETT COMPANY, Limited
Montreal Toronto Winnipeg Vancouver

FAR-SIGHTED highway officials plan to reduce road troubles next spring by repairing and strengthening their roads *now* to withstand the ravages of winter.

Naturally they turn to "Tarvia-KP", the easy-to-handle, cold-patching material. It is remarkably economical—only 12 gallons are needed to the cubic yard of stone.

Our booklet, "Helpful Hints for the Foreman of the Repair Gang," tells how to make durable, economical patches with "Tarvia-KP". Write for it.

*John V. Schaefer*

**Cement Gun Construction Co., Chicago, Ill.**, 537 S. Dearborn Street. Branch offices: Oliver Building, Pittsburgh, Pa., and Grand Central Terminal, New York. Organized 1914. Bus. Vol. C. This company was organized by Carl Weber, the inventor of the concrete chimney, and John V. Schaefer of Roberts & Schaefer Co. and of the Link-Belt Co. In 1918, Mr. Weber sold out to go into the business of building concrete ships, and since then the business has been conducted by John V. Schaefer. At the time of organization, the Cement-Gun was in its experimental stages, and Messrs. Weber and Schaefer put the Cement-Gun on a practical basis. Officers: John V. Schaefer, President and Treasurer; Frank Beeby, Vice-president; Arthur Johnson, Secretary. Major contracts: 1925, conservation and repair of large concrete dam in northeastern Maine; 1926, partitions and ducts in ventilation buildings of Holland Tunnel, New York; 1927-8, guite steel protection of structure in basement and sub-basement of Park Avenue Building, New York; 1928, gunite lining of coal bunkers, breechings and stacks of State Line Power House, Hammond, Ind. Member: Western Society of Engineers, Chicago, Ill.

**Ralph Dunn, Fort Wayne, Ind.**, 417 Greenlawn Avenue. Organized 1917. Bus. vol. D. Officers: Ralph Dunn, owner. Major contracts: dwelling house construction only.

**P. J. Karstens & Son Co., Chicago, Ill.**, 2123 N. Clark Street. Organized April 1, 1928. Bus. vol. E. This company was established in 1893 as P. J. Karstens, constructing chiefly, large floors and sidewalks. Officers: Peter J. Karstens, President; Norman V. Karstens, Secretary and Treasurer. Major contracts: 1926, Broadview subdivision; 1927, Sheffield Avenue Post Office, and Wieboldt Building.

**Independent Construction Co., Davenport, Iowa**, 306 Citizens Bank Building. Organized February, 1906. Bus. vol. E. Officers: M. F. McCarthy, President; E. J. Carroll, Vice-president; H. J. Parker, Secretary and Manager. Major contracts: complete sewer system for Hanover, Ill.; main storm drain for Aledo, Ill.; complete storm drain sewers for Glen Oaks Add. to Moline, Ill.; drainage system for International Harvester Co., East Moline, Ill. Member: Mid West Improvement Association, and Illinois Improvement Association.

**L. T. Wright & Co., San Antonio, Texas**, 910-11-12 Builders Exchange Building. Branch office: Corpus Christi, Texas. Organized Jan., 1921. Bus. vol. B. This business was operated as a partnership as Wright & Sanders from 1913 to 1921, then as a partnership of L. T. Wright and J. T. Haile under the present name. It was incorporated in 1926. Officers: J. T. Haile, President; L. T. Wright, Vice-president and General Manager; R. C. Hill, Vice-president; D. G. Francis, Secretary-Treasurer. Major contracts: 1925, Y. M. C. A. Building at San Antonio; 1926, Aztec Theatre, San Antonio, and Nixon Office Building at Corpus Christi; 1927, Milam Building at San Antonio, and 15 acres of warehouse buildings at Corpus Christi. Member: San Antonio Builders Exchange, San Antonio Chamber of Commerce, U. S. Chamber of Commerce, and A. G. C. of A.

**Williams, Richardson & Reece, Inc., Kellogg, Idaho**, 11 W. Station Avenue. Organized March, 1925. Bus. vol. E. This company was organized in 1916 as Galvin & Richardson, in 1918 after Mr. Galvin's death as Williams & Richardson Co., specializing in concrete work. Since the present reorganization the company has handled general construction, including carpenter shop, building work, steam shovel excavation, and has run a building supply yard, retailing lumber, etc., to the retail trade. Officers: Max R. Crosby, President; Giles F. Reece, Vice-president; D. Williams, Secretary-Treasurer. Major contracts: 1925, concrete hoisting station for Bunker Hill & Sullivan Mines, two miles underground; 1926-7, Jack Waite Mine concentrator; 1927, Post Office and hotel building at Kellogg; 1927-8, electrolytic zinc smelter for Sullivan Mining Co. Member: Kellogg Chamber of Commerce.

**F. W. Myreck, Chicago, Ill.**, 7353 Yale Avenue. Branch offices: 7609-15 Wentworth Avenue, and 5600 and Central Avenue, Chicago, Ill. Organized 1896. Bus. vol. D. This business is conducted as an individual, the work done in the last thirty years being track elevation for the C. & W. I. R. R. Co., Grand Trunk R. R. Co., New York Central R. R. Co. and Penna. R. R. Co. Minor jobs for the city of Chicago and various private parties, principally the Chicago Transfer & Clearing Co., and work for the Lawrence P. Romano Co.

**Subway Engineering Co., Chicago, Ill.**, 115 S. Dearborn Street. Organized October, 1920. Bus. vol. E. This company was organized for the construction of shafts, tunnels, subways, reservoirs, wood, steel and concrete bridges, waterworks and sewage plants. Officers: Ernest A. Clark, President and Chief Engineer; Leon L. Clarke, Secretary and Treasurer. Major contracts: 1925, reservoir and tunnel for water-works system at Calumet City, Ill., $120,000; 1926, tunnels for Sanitary District of Chicago at North Side Treatment Plant, Chicago, $75,000; 1926-7, Sixth Street Bascule Bridge at Michigan City, Ind., $105,000; 1927, Sewage Pumping Station and outfall sewer at Calumet City, Ill., $110,000, and four Sewage Pumping Stations at Hammond and East Chicago, Ind., $90,000.

**Emil Diebitsch, Inc., New York**, 70 East 45th Street. Organized 1920. Bus. vol. B. From 1898 until 1915 Mr. Diebitsch was first Superintendent of Construction and later Vice-President and Chief Engineer of the John Pierce Co. In 1915 he went into busines for himself, incorporating the present company in 1921. Officers: Emil Diebitsch, President and Treasurer; Henry T. Chapman, Vice-President; George R. Offerman, Secretary. Major contracts: 1925, Erasmus Hall High School, Brooklyn, N. Y., $1,077,000, and alterations to Hotel Biltmore, New York, $151,800; 1926, New York Training School for Teachers, New York, $1,735,000, and alterations and additions to Harriman National Bank, New York, $900,000; 1927, East 175th Street Telephone Building, $850,000, and English Lutheran Church of the Redeemer. Member: Building Trades Employers' Association of New York, The Credit Association of the Building Trades of New York, and A. G. C. of A.

**J. A. Greenleaf & Sons Co., Auburn, Maine**, 20 Washington Street. Organized April, 1909. Bus. vol. D. The business was established in 1874 by John A. Greenleaf, and specializes in heavy construction, mills, factories, power plants, and hydraulic developments. Officers: William A. Greenleaf, President; Fred B. Greenleaf, Treasurer. Major contracts: woolen mill, dam and power house for Park Mills, Inc., Sabattus, Maine; woolen mill and dam for Farnsworth Mill, Lisbon Center, Me.; miscellaneous dams for Central Maine Power Co., Augusta, Me.; shoe factory for Cushman-Hollis Co., Auburn, Me.; bridge, piers and abutments over Androscoggin River, Turner, Me.; bridge, piers and abutments over Pemboscot River, Grundstown, Me.; bridge, piers and abutments over the White River, Hartford, Vt.; paper mill additions for Great Northern Paper Co., Millinockat, Me.

**With**

**BROOKVILLE LOCOMOTIVES**

***(McCormick-Deering-International Power Units)***

***on the job***

**BROOKVILLE Locomotive, 5-Ton Model "IBZ"**

**ECONOMICAL OPERATION**

***becomes the Keynote of your business—***

**UNPRECEDENTED SPEED**

***ensures completion of work in advance of schedule time with***

**INCREASED PROFITS**

***guaranteed on every contract tackled***

***BROOKVILLE LOCOMOTIVES***

***are unequalled for***

**ROAD CONSTRUCTION**
**STREET BUILDING**
**GENERAL CONTRACTING**

***They are offered in***

**15 — Standard Models — 15**
**from**
**1½ Tons Weight**
**to**
**12 Tons Weight**
**with**
**3 Forward SPEEDS Reverse 3**

***It will pay you to consult Brookville before tackling your next job. DO IT TODAY!***

***BROOKVILLE LOCOMOTIVE CO.***
***BROOKVILLE, PA.***



**JAEGER'S**

**Spring Mounted**

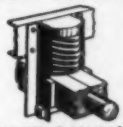
***7-S Mixer***

***at a $200 saving***

***under market prices***

~ 100% BALL BEARING EQUIPPED ~

LOW CHARGE



SPRING HUNG CHASSIS- *adds Years to Life!*

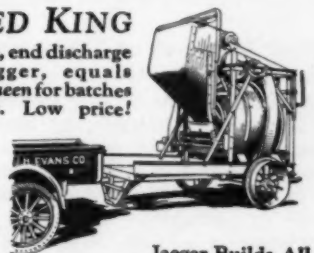
SKIP SHAKER

EVERY production advantage as the world's biggest makers of concrete mixers has gone into this one-bag mixer. It means a saving of $200 to you at the start, plus more batches a day and longer life.

Short coupled, with 100% roller bearing steel disc wheels, men handle it nicely on soft ground. Weighs about 3500 lbs. complete with 2 cylinder Le Roi engine, Accurate Measure Water Tank.

**SPEED KING**

portable, end discharge one bagger, equals *Speed Queen* for batches per day. Low price!




*IT TRAILS ANY-WHERE*

**Jaeger Builds All Sizes from 3½S up to 28S Mixers**

MAIL THIS FOR CATALOG, PRICES AND TERMS!

**The Jaeger Machine Co.** Date_____
701 Dublin Avenue, Columbus, Ohio

☐ NON-TILT MIXERS ☐ TILTERS ☐ PLASTER MORTAR MIXERS (Check where desired)

Name_____

Address_____

City_____ State_____

# Legal Points for Contractors

***These brief abstracts of court decisions in the contracting field may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt consult your own attorney***

**Edited by A. L. H. Street, Attorney-at-Law**

### General Contractor Was Not Liable for Defect in a Scaffold Erected by a Subcontractor

A building was being erected in upstate New York. Plastering subcontractors had erected staging and employes of the painting subcontractor went upon it to paint the ceiling. The staging fell and injured plaintiff, an employe of a third subcontractor who had charge of the electrical work.

In the case of De Lee vs. T. J. Pardy Construction Co., 226 N. Y. Supp. 345, decided January 17, 1928, plaintiff unsuccessfully attempted to hold defendant, the general contractor, liable for the accident. Ordering the suit dismissed, the Appellate Division of the New York Supreme Court said, in part:

"'The general rule applicable to persons occupying real property for business purposes is that they must use reasonable prudence and care to keep their property in such a condition that those who go there shall not be unreasonably and unnecessarily exposed to danger.' . . .

"We think the defendant complied with this rule. It had nothing to do with the construction of this scaffold. The subcontractors personally took charge of its construction, and it is not suggested that they were lacking in skill or experience for such work. It does not appear that at any time any defect in this scaffold was known to the defendant, or to any one on the job. The men who were at the time working on the scaffold were scattered substantially its entire length; not more than two or three were together in one place. It is not suggested that defendant had any reason to suspect the strength of the scaffold, or to apprehend any danger therefrom. While its superintendent, Lynch, had general charge of the work, to see that it was being performed according to the plans and specifications, he did not have charge of the tools or appliances furnished by any one of the subcontractors, or what means any subcontractor used in performing his work. His only authority was to see that the result complied with the plans and specifications."

### Filling in Marsh or Submerged Lands was a Lienable Improvement

A Florida statute declares that "Liens shall exist in favor of any person performing by himself or others any labor upon or in any farm, orchard, grove, garden, park, or other grounds, whether in clearing up, fencing, ditching or draining, or in maintaining, improving or cultivating the same; upon such . . . grounds."

Whether or not this section applied to the facts of the case of Clark Dredging Co. vs. Sunny Isles Ocean Beach Co., 116 So. 644, was the question answered by the Florida Supreme Court in an opinion handed down April 26, 1928. The court stated its conclusion as follows:

"Where a person, firm or corporation dredges and fills in submerged or marsh lands under a contract with the owner to do such dredging, filling, and improving, the one performing such labor acquires a lien upon the grounds so dredged, filled and improved for the amount found to be due from the owner, . . . and it is immaterial whether such labor be performed by hand or by the use of machinery."

### Rights of Contractor's Assignee

Where a state highway contractor assigned to a bank funds to be payable under the contract, to secure repayment of loans made by the bank, the bank did not become entitled to any funds that would not have been otherwise payable to the contractor, held the United States Circuit Court of Appeals, Eighth Circuit, in the case of Maryland Casualty Co. vs. Dulaney Lumber Co., 23 Feb. (2d series) 378, decided January 14, 1928. Labor and material claims were superior to any claim held by the bank.

### Death of a Member of a Firm of Contractors Does Not Terminate the Contract

Although death of one member of a partnership engaged in contracting terminates the partnership, so far as new business is concerned, it remains the right and duty of the surviving member or members of the firm to carry out unperformed contracts. It was so declared by the Springfield, Mo., Court of Appeals in the case of Whitesell vs. Pioneer Construction Co., 2 S. W. (2d series) 147, decided January 20, 1928. Accordingly, it was held that an assignment of funds to become due a firm under a state highway contract, as security for advancements made to the firm, was valid as to advancements made after one of the partners died.

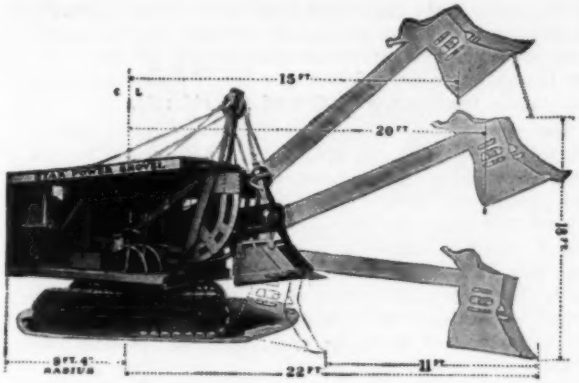
### Implied Warranty of Contractors' Equipment

In the case of Bekkevold vs. Potts, 216 N. W. 790, the Minnesota Supreme Court decided (December 2, 1927) that where the seller knew the particular purpose for which an outfit consisting of a tractor, a two-wheeled truck, a connecting hitch, and a hydraulic hoist for unloading, were being bought, there was an implied warranty that the outfit was reasonably fit for that purpose. The court decided that implication of such warranty was not defeated by the fact that the written contract contained this clause: "No warranties have been made in reference to said motor vehicle by the seller to the buyer unless expressly written hereon at the date of purchase."

### When Construction Corporations Go Into Other States

Many of the states have statutes that make it hazardous for a contracting corporation to engage in intrastate business in a state other than where it was organized, unless a permit be first obtained from the secretary of state of that jurisdiction. In some instances, failure to do this may result in inability to recover compensation for work done or damages for breach of the contract.

But in the case of Richmond Screw Anchor Co. vs. E. W. Minter Co., 300 S. W. 574, decided by the Tennessee Supreme Court November 21, 1927, it was held that execution of a single building contract in that state by a nonresident corporation did not require the company to register in the state although the work continued for a year, and although the same company had engaged in a similar transaction in Tennessee some years before.




# The Star Power Shovel

**The *One* and *Only* Shovel Using The Patented Telescoping Skimmer Bucket Handle**

**Works in Close Quarters**
**Does Shallow Grading as Well as Bank Work**
**Weighs 18 Tons. Full-Revolving**
**Full-Length Crawlers**
**60-hp. Waukesha Engine**
**Convertible into Sub-digger or Crane**

***Write for catalog and complete details today***

**Skimmer — Grader — Ditcher**
**Backfiller — Crane**

The Star is truly an all-purpose machine—an efficient performer in all classes of work.

Quick-acting. Easy to handle. Sturdy. Easily serviced.

By all means investigate its possibilities as a profit-earner for you.

## THE STAR DRILLING MACHINE CO.

505 Washington St., Akron, Ohio

## ANYONE CAN USE THEM

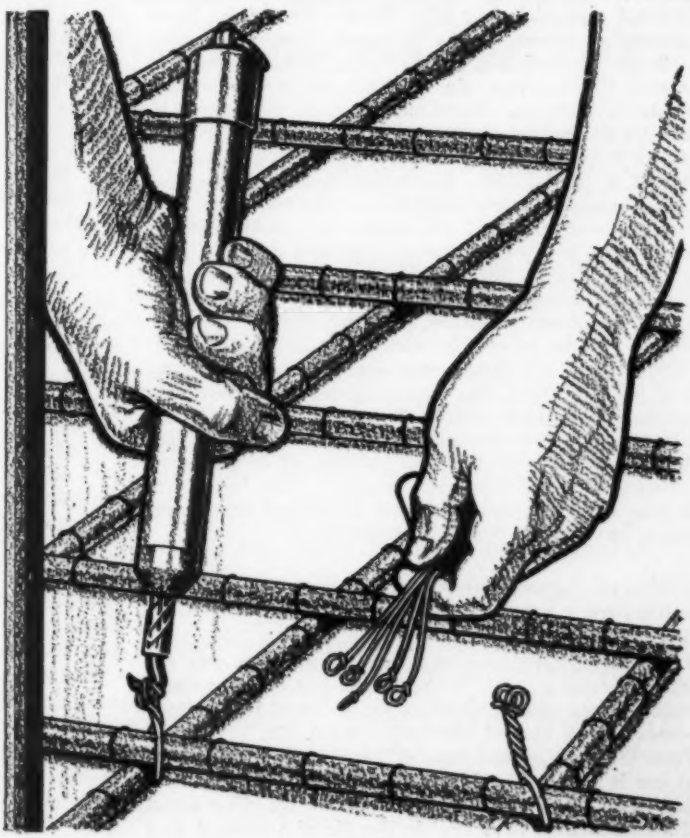
WITH Bates Wire Bar Ties and a Bates Tying Tool, an unskilled laborer can tie reinforcing rods as securely and quickly as an expert.

On some of the largest reinforced concrete jobs in the country, the use of Bates Ties and Tools has cut rod-tying time in half and reduced the labor cost for this operation to a minimum.

Save money! Write now for a free trial outfit of one Tying Tool and sample Ties in assorted sizes and test their advantages yourself.

BATES VALVE BAG CORPORATION
35 E. Wacker Drive Chicago, Ill.

# BATES WIRE BAR TIES



## A Statute Cannot Invalidate a Pre-Existing Contract

Noting that contracts for public work cannot be abrogated by subsequently enacted legislation, the Arkansas Supreme Court said in the case of Taylor vs. Rogers, 2 S. W. (2d Series) 56, decided January 30, 1928:

"All valid contracts for road construction let prior to the passage of the Martineau Act could not be abrogated or impaired by any action of the Legislature. In Morgan Engineering Co. vs. Cache River Drainage Dist., 115 Ark. 437, 172 S. W. 1020, this court said:

" 'It is well settled under our Constitution that the Legislature may not pass an act impairing the obligation of a contract. The board of directors of the drainage district made a valid and binding contract with the engineering company to furnish all the engineering services that would be required in the preliminary surveys and also for the construction of the ditches required under the terms of the act. Any law passed by the Legislature, the effect of which would be to impair the binding force of this contract, would be contrary to the Constitution and void.' "

## General Contractor Is Not Liable for Negligence of Hauling Subcontractors' Employes

A mentally incompetent chap ran into the pole of a wagon that was being used in Denver to haul dirt away from its place of excavation, or the pole ran into him. His guardian brought suit against the general contractor, Francis J. Kirchhof. Stevens, the man who was driving the wagon at the time of the accident, was employed directly by Roy F. Myers, to whom Kirchhof had sublet the work of hauling the dirt away. Holding that no cause of action was proved against Kirchhof, the Colorado Supreme Court said in announcing its opinion April 2, 1928, in this case (Thayer vs. Kirchhof, 266 pac. 225):

"Kirchof contracted only with Myers. He did not know Delashmutt or Stevens or that either of them was at work on this job. His relation, at least so far as it grows out of an express contract, was only to Myers, and it was not that of master and servant. Myers merely agreed to furnish Kirchhof with all the wagons, teams, and drivers the latter needed to carry away the dirt which Kirchhof by his workmen excavated on the May lot. Myers furnished all the facilities for doing so—a complete equipment. The mere fact that Myers employed and paid the drivers and could discharge them at pleasure is not, of course, conclusive as to the relation existing between him and Kirchhof, but Myers did not part with or surrender any control over his drivers in doing the work, which was ultimately, of course, for the benefit of Kirchhof. In the process or work of hauling dirt, neither Kirchhof himself nor his foreman assumed or exercised any control whatever over the drivers further than merely to direct them where to go with their wagons to receive the dirt which was placed in the wagons by Kirchhof's workmen. In the actual hauling or driving or management of the teams, the Myers' drivers and the ones supplied to him by Delashmutt were under the sole control and direction of the original employer by whom they were hired and paid."

## Validity of Agreement to Increase Contractors' Compensation

One of the most important decisions affecting contractors that has been handed down by the courts in a long time was rendered October 3, 1927, by the Connecticut Supreme Court of Errors in the case of Blakeslee vs. Board of Water Commissioners of the City of Hartford, 139 Atl. 106.

There is a fundamental rule of law that a promise to do what one is already bound to do is not a sufficient legal consideration to support some new promise by the other party. And a consideration is as vital to the life of a contract as a heart or lungs are to a man.

This rule of law has been given very strict application by the courts in the past, often resulting in virtual oppression of contractors who have not had the foresight to guard against some contingency by express provision in their contracts. But the Connecticut court points a way toward harmonizing Law and Justice through a relaxation of the old rule.

The court upheld an agreement by defendant to pay increased compensation for the building of a dam. The contract was made in 1915 and required completion in 33 months and payment of $100 a day liquidated damages for delay beyond that time. In 1916 looming war conditions showed that it would be impossible to complete the work within the time fixed or at a cost within the price mentioned in the contract. Thereupon, the parties agreed that, if the Legislature should so authorize, the compensation would be increased to the actual cost of doing the work, and that the time limit in the contract should be waived. The Legislature passed a law purporting to confer that authority. But the defendant insisted that, under the rule above stated and under the Constitution of Connecticut the agreement for additional compensation was void. The court held that plaintiff's complaint on its face showed a right to recover, saying, in part:

"The rule which holds that a promise of additional compensation is without consideration, if the promisee does or promises to do only that which he is already under a contract obligation to do, cannot be satisfactorily rested upon the ground that the promisee has suffered no detriment and the promisor received no benefit, nor upon the ground that the promisee has no right to take any other course than to perform. In fact, no satisfactory solution of the problem can be reached upon the basis of denying that there can be under any circumstances consideration for a promise of additional compensation in such a case, but the circumstances of the particular case, or at least of the class of cases under consideration, must be considered . . . It may well be that there is in fact no appreciable detriment to the promisee or benefit to the promisor in many cases where a promise is made to induce the performance of that which the promisee is already under a contract obligation to do; such would be the ordinary case of a promise to pay a debt which is already owing and immediately due . . . Nor a mere agreement to accept a part of a debt in satisfaction of the whole . . . And it may well be that broadly to admit the power of a contractor to exact additional compensation by refusing to continue performance would afford to many opportunities for exactions, approaching very near to extortion . . .

"Here the way is open for a distinction which commends itself at once to good sense and good morals. Where the contractor can justify his refusal to proceed with the contract by showing that he is confronted with circumstances not contemplated when the contract was made which render its performance impossible or unduly onerous, and the promisor, being informed of the situation, induces him by a promise of additional compensation to proceed with it, the contractor's right to that compensation ought justly to be recognized. However, where a contract must be performed under burdensome conditions not anticipated, and not within the contemplation of the parties at the time the contract was made, and the promisee measures up to the right standard of honesty and fair dealing, and agrees, in view of the changed conditions, to pay what is then reasonable, just and fair, such new contract is not without consideration."

But the court held that the possibility that conditions might have again so changed as to have enabled the contractors to have completed the dam at an actual cost less than the original contract price, in which case the city would have had the benefit, might be regarded as a consideration for the promise made to pay the actual cost, rather than the original contract price, although it later proved that the actual cost was $159,000 more than the contract price.

251

# Newark
## REINFORCED CONCRETE PIPE
*"It makes a better joint"*

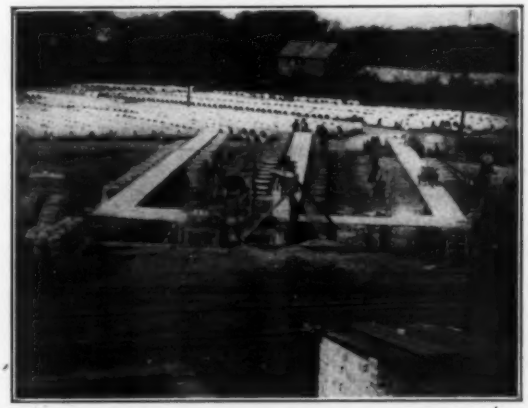
Laid in minimum time—

At minimum expense—

With minimum effort—

This pipe, when laid, has a minimum resistance to flow, because the inside of each joint is so smooth!

Contractors and engineers all heartily endorse it!

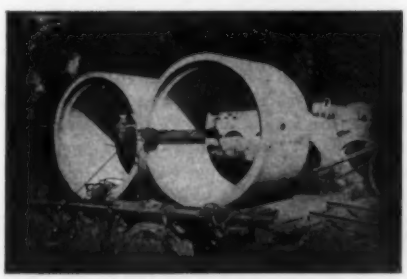


**Write us for sketches showing types of joints furnished**
***(Send a post-card)***

## NEWARK CONCRETE PIPE COMPANY

**462 Broad St.**

**Newark, New Jersey**



# Why The Thor Six COMPRESSOR Delivers 26% More Air?

# It's All in the *Super-Charger*

The reason the Thor Six Compressor delivers 26 per cent more air than any other compressor of the same rated capacity is that it has a super-charger. The Rix Super-Charger is an exclusive, patented feature that enables the piston on its idle or downward stroke to compress the additional air the Thor delivers.

Instead of the Thor being 60 or 65 per cent efficient, as is the case with other compressors, the Super-Charger makes it 83 per cent efficient. In other words, the Thor is rated at 116 cubic feet and actually delivers 96 cubic feet of air per minute.

You not only get more air from a Thor, but you also get a Compressor that is designed and built along modern engineering principles. The Thor is direct-connected, both engine and compressor being mounted on a common crankcase, eliminating gears, clutches and couplings. Ask any Thor user how this construction has reduced his upkeep cost.

By all means, investigate the Thor 6. It isn't going to cost you anything but a few minutes of your time and the saving involved is well worth it. Write for Bulletin P. C. 103.

**THE THOR COMPRESSOR CAN ALSO BE FURNISHED IN A LARGER SIZE—250 CU. FT. RATED CAPACITY. WILL DELIVER 210 CU. FT. OF AIR. HAS THE SAME EXCLUSIVE FEATURES AS THE SMALLER SIZE. WRITE FOR COMPLETE INFORMATION.**

## INDEPENDENT PNEUMATIC TOOL CO.

**600 West Jackson Blvd.**

**Chicago, Illinois**

**FACTORY, AURORA, ILL. BRANCHES ALL OVER THE WORLD**

# Construction Industry News

**The Chicago Pneumatic Tool Co.**, 6 East 44th Street, New York, has announced the appointment of H. H. Sherman as Manager of the Publicity Department with headquarters at its general offices, New York. Mr. Sherman joined the company in 1927 and has had many years' experience in industrial advertising and advertising agency work.

**The Ransome Concrete Machinery Co.**, Dunellen, N. J., has appointed the Western Contractors Supply Co., 14 No. Clinton Street, Chicago, Ill., as exclusive distributors in the Chicago territory for Ransome line mixers, pavers, and chuting equipment, this becoming effective as of August 27. The Western Contractors Supply Co. will carry a complete line of Ransome equipment, and has taken over the Ransome factory trained service organization which that company had in Chicago for some time.

**The Linde Air Products Co.**, 30 East 42nd Street, New York, has started the production of oxygen in five new plants. On July 3 a plant at 631 South 17th Street, Harrisburg, Pa., started operating in charge of J. J. Naber. A plant at 17th and West Lawrence Streets, Allentown, Pa., in charge of W. Barber, began production on July 18. On August 1, the Shreveport, La., plant, located at Foster and Thomas Streets, in charge of F. T. Rueger, started operating. A plant at First Avenue and B Street, South Charleston, W. Va., was also added to the chain, with Ed. Pohlman as Superintendent, starting August 10. Another plant at 125 Settlement Street, Akron, Ohio, under the direction of A. Deagon, Superintendent, will supply the nearby demand for oxygen for welding and cutting processes. This brings the total Linde oxygen producing plants throughout the country up to fifty-four.

**Earle S. Philips**, Vice-President and Manager of The Good Roads Machinery Co., Inc., Kennett Square, Pa., is on an extended trip to the Pacific Northwest. From that section the itinerary will include the entire Pacific Coast territory with a return via the Southern route. Mr. Philips is making this trip to intimately study conditions in the various sales territories as relating to the products of the company, and visiting the direct representatives and dealers who represent the company from coast to coast.

**The Killefer Manufacturing Co.**, Los Angeles, Calif., has announced the appointment of C. O. Perrine as General Sales Manager. Mr. Perrine was formerly sales research engineer for the Caterpillar Tractor Co., San Leandro, Calif., with which organization he has been associated for seven years.

**The Prest-O-Lite Co., Inc.**, 30 East 42nd Street, New York, has recently added two new plants to its nation-wide chain, making the total thirty-three. These will serve nearby industry with dissolved acetylene, used in oxy-acetylene welding and cutting. A plant, in charge of H. A. Smith, at 631 South 17th Street, Harrisburg, Pa., started production on July 12, and another at 17th and W. Lawrence Streets, Allentown, Pa., with J. W. Summers, Superintendent, commenced operations on July 21.

**The Byers Machine Co.**, Ravenna, Ohio, through its President, H. C. Beckwith, has announced the closing of its Massillon, Ohio, plant, formerly the Massillon Power Shovel Co. Equipment and inventory have been moved to Ravenna, where the 15-acre site and a dozen buildings formerly occupied by the National Carbon Co. have been secured. By rearrangement of the Ravenna plant and expansion into the new area, the change has been made with very little new building. In addition to operating economies and provision for rapid increase in production of power shovels, cranes, and similar road and building construction machinery, the program insures adequate weather-proof storage of an inventory sufficient to meet peak seasonal demands, and large testing grounds. Growth of both foreign and domestic demand in the construction fields led to the adoption of this program.

**The Morse-Starrett Products Co.**, 1916 Broadway, Oakland, Calif., has been organized to handle the sales of the W. D. Starrett Metal Cutting Products Co., Alameda, Calif., manufacturer of the Starret cable cutter, which cuts any grade or size of cable up to one-inch, putting the seizing or whip on both ends to prevent fraying.

**The Lincoln Electric Co.**, Cleveland, Ohio, has announced the opening of a San Francisco office at 533 Market Street, in charge of W. S. Stewart. L. P. Henderson, formerly of the Chicago office, has been transferred and put in charge of the Minneapolis district. Robert Notvest has been transferred from Kansas City to Indianapolis, where he will have charge of the Indianapolis district. R. E. Mason has been sent to Kansas City to replace Mr. Notvest. N. L. Nye has been stationed at Akron, Ohio, under the direction of R. P. Tarbell, Manager of the Cleveland District.

**The T. L. Smith Co.**, Milwaukee, Wis., manufacturers of Smith mixers and pavers, has announced the appointment of the J. D. Harbison Equipment Co., of Little Rock, Ark., as distributors for that state. J. B. Harbison is well known to the trade, having been formerly associated with the O. B. Avery Co. Announcement is also made of the appointment of the Newlin Motor Co., of Kansas City, which has organized a separate department for the handling of the sales of contractors' equipment under the name of the Industrial Machinery Co. This company will distribute Smith mixers in Kansas City.

**The Trackson Co.**, Milwaukee, Wis., has announced the appointment of a number of new distributors as follows: Wm. Ford & Co., Inc., 15841 Second Boulevard, Highland Park, Detroit, Mich.; Industrial Power Co., 2618 Fond du Lac Avenue, Milwaukee, Wis.; Industrial Tractor Sales Co., Inc., 180 No. Michigan Avenue, Chicago, Ill.; and the Hooper Equipment Co., 523-527 East Washington Street, Indianapolis, Ind.

**The Gypsum Institute**, 110 West 40th Street, New York, was organized recently to include gypsum manufacturers. For a number of months the gypsum industry has been in an unsatisfactory condition as, although building construction has been active, the prices of gypsum products have steadily declined in 1928, so that today gypsum products are being offered at or below cost. The new organization will take over the properties of the Gypsum Industries, Inc., which suspended activities on May 1 and will function in much the same manner and with some of the same personnel as the old association. The officers are President James Leenhouts, Vice-President and General Manager of the Grand Rapids Plaster Co., Grand Rapids, Mich.; First Vice-President, Eugene Holland, President of the Universal Gypsum and Lime Co., Chicago, Ill.; Second Vice-President, L. I. Neale, Sales Manager of the Atlantic Gypsum Products Co., of New York; Secretary and Treasurer, W. J. Fitzgerald, New York. Other members of the Board of Directors are F. G. Ebsary, President of the Ebsary Gypsum Co., Scottsville, N. Y.; and J. F. Haggerty, President of the National Gypsum Co., Buffalo, N. Y.

# EUCLID CRAWLER WAGONS

**The fast and economical performance of the first six wagons put on this job sold twenty more**

Starting in the middle of last winter and working continuously ever since Euclid Crawler Wagons have moved the bulk of the earth on the largest real estate development in Cleveland. Over a million and a half yards of excavation are involved.

Several contractors have been handling this job. Some use single Euclid Wagons behind their Caterpillar thirties; others pull two or three behind their sixties, as the length of haul and ground conditions permit.

The Single Wagon units frequently demonstrate their usefulness in quickly backing and placing loads in almost inaccessible places.

The Wagons in train track closely even in turning short under shovels, and work at high efficiency on the long hauls, which are sometimes as great as 1500 feet.

The wagon dumpers like the easily operated rear controls where they feel safe as they swing up on the rear corner step to dump the loads or to raise the doors.

The Euclid crawler wagon is without question the strongest and most easily handled wagon of its type in the field.

**EUCLID CRAWLER WAGONS MOVE MORE EARTH AT LESS COST.**

***Write for full specifications***

## THE EUCLID CRANE & HOIST CO.

**EUCLID, OHIO**

LAUSON

## Mixers and Diaphragm Pumpers

***A Team That Can't Be Beat***

For sturdy simplicity and rugged construction you'll not find these outfits equaled or even approached. Their reputation is based upon the correct engineering which is conspicuous in every detail.

***They Both Have the Famous "Lauson Engine"***

**This ½ Bag Semi-Trailer**

has semi-automatic discharge, dependable lock, most effective blade action, drum spindle mounted on bronze bearings—the original Timken equipped mixer. Ask about our new ½ Bag Loader Mixer—Vertical Lift—⅓ narrower.

*We also manufacture Gas Engines for every purpose, 2 to 35-hp. and 35-45-hp. Heavy - Duty Power Units. Concrete and Plaster Mixers and Contractors Saw Rigs.*

**This Enclosed-Gear Jack**

is driven direct from engine crankshaft, with gears running in oil, bronze bearings, four iron wheels or solid rubber tired semi-trailer. Complete units, or minus pump with all fittings ready to mount your own pump. Electric motor if preferred.

***Write for Full Details***

The JOHN LAUSON MFG. CO. 11 Jackson St. N. Lauson, Wis.

# An Economical Air Compressor

ECONOMY, efficiency and durabilty are a few of the features of the Type 90-C air compressor of The Buhl Co., 405 South Dearborn Street, Chicago, Ill. This outfit has a displacement of 90 cubic feet of air per minute, and will operate one large rotating drill, two small rotators, three clay spades, two riveting hammers, four calkers or chippers, two pavement breakers, four tie tampers, one sand blast outfit, or any other tool or device requiring a similar amount of air.

The single cylinder cast en bloc with the engine makes for rigid, strong construction, lessening vibration and eliminating connecting contraptions. The crank-shaft is made of high carbon steel forging, heat treated. It has an outside counterweight, causing perfect balance of stroke. The crank case is fully enclosed, protecting all working parts from dust and grit. The side plates make adjustment or replacement possible quickly. The crank-shaft bearings are bronze backed, babbitt lined-renewable bushings. The inlet valves are mechanically operated, and are dependable and efficient. Large air-ports offer minimum of air resistance.

*The Latest Buhl Portable Air Compressor With a Capacity of 90 Cubic Feet Per Minute*

The engine and compressor cylinders have large water areas, belt-driven fan and an extra capacity radiator keeps the cylinders and heads cool. The carburetor is of the automatic float-feet type. The high tension magneto with impulse starter furnishes hot-spark at all cranking speeds. A mechanical force-feed oiler delivers fresh oil, a drop at a time, assuring positive and constant lubrication.

The outfit is furnished regularly on steel truck mounted, or built with any style of mounting desired. When intended for outdoor service it is fully protected by a rigid, well-built, all-steel house with doors that can be locked.

# An Earth Boring Machine

A COMBINATION earth boring machine and pole setter has been developed by the Highway Trailer Co., Edgerton, Wis.

The boring unit and pole setting equipment are mounted on a crawler-equipped tractor, the power from the tractor motor being used for operation of earth auger and winch.

The crawler equipment on the tractor makes possible the operation of the machine in all kinds of soil conditions and over extremely rough topography. It will traverse swamps and underbrush where it would be almost impossible for men to go afoot; it will climb embankments and knolls; travel through hollows and ditches, and will bore the hole and set the pole wherever it goes.

The feasibility of dragging the pole with the winch line while the hole is being dug, in readiness to be set as soon as hole is completed is made a reality by the pole derrick and capstan winch with which the machine is equipped. The pole derrick is 17 feet long, made of 3½-inch diameter 40-carbon steel tubing, and is capable of setting poles 45 feet in length.

*A Combination Earth-Boring Machine and Pole Setter in Operation*

The winch and its power take-off are of sturdy construction and of ample capacity to handle poles of sizes within the limits of the earth auger, which is 24 inches in diameter in favorable soil conditions.

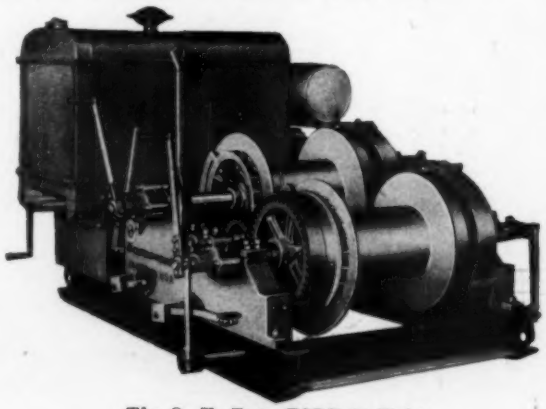
A record recently established by the machine on actual line construction was a pole in the ground every 5½ minutes.

# A 2-Speed Slackline Cableway Hoist

FOR operating slackline excavator buckets in sand, gravel or other material, the O. K. Clutch and Machinery Co., Columbia, Pa., has brought out a 2-speed slackline cableway hoist, Type TSBD 50, with gasoline engine or electric drive; also larger sizes. Simplicity of operation is one of the outstanding features, and all the features of the O. K. heavy-duty hoist line have been embodied in this unit.

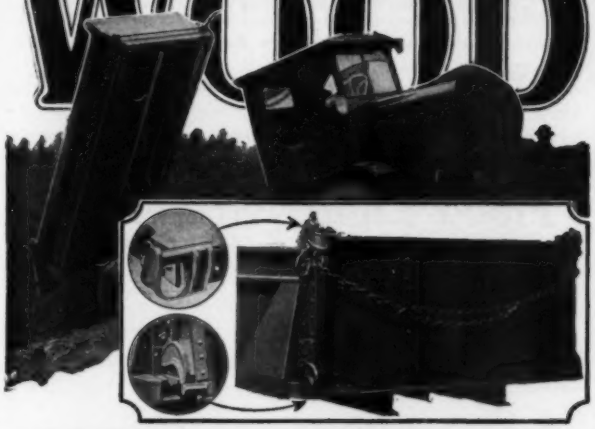
The rear drum, handling the line which tightens the track cable, has a constant speed. The front drum, operating the bucket line, engages the low speed friction while the bucket is being filled and is then engaged with the higher speed friction, thus accelerating the traveling speed of the bucket as it moves to the dumping point. As the bucket nears the unloading point the low speed friction is again engaged and the bucket again travels slowly, and dumps.

The unloaded bucket returns by gravity to the digging point. Lowering of the track cable and gravity bucket return are controlled by foot brakes acting on the drums, and may be as slow or as fast as the operator desires. Only two hand-levers are used, and two foot-operated brake levers, this simplicity of operation meaning more trips per day.



*The O. K. Type TSBD 50 Hoist*

# WOOD



## HOISTS-BODIES

Through a period of continuous growth covering eighteen years which parallels the entire life of the dump truck industry, we have never sacrificed our close, personal contact with dump truck users. Every transaction whether with the owner of one dump truck or with a big fleet corporation is a personal transaction.

This personal service has created a relationship which is appreciated alike by users of dump trucks and ourselves.

A WOOD STEEL DUMP BODY for every purpose and requirement. WOOD HOIST for every make, model and capacity of motor truck. A Sales and Service Organization that is world-wide.

WOOD HOISTS-BODIES

***Complete information upon request***

**Wood Hydraulic Hoist & Body Co.**

***Pioneer Builders of good Hoists and Steel Dump Bodies***

**Detroit, U. S. A.**

# FLORY

## CABLEWAYS

Some of the world's largest engineering projects have used FLORY Cableways and proved their efficiency and dependability.

FLORY Cableways are adopted to Dam Construction, Open Quarries, Bridge Building, etc. In these fields and many others they often are the most economical means of material handling.

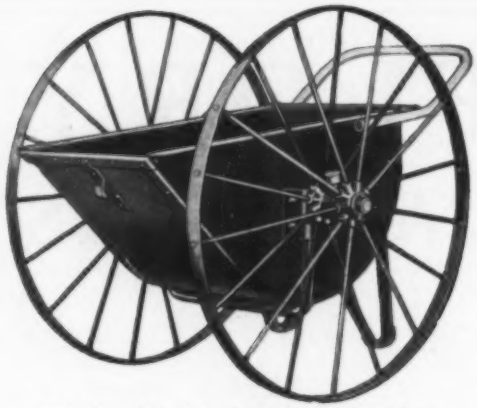
***Write for Bulletins***

**Flory builds Gasoline, Steam, Electric, Belt-Driven, Hoists, Cableways, Carpullers, etc.**

**S. FLORY MFG. CO.**

**BANGOR, PA.**

***SALES AGENTS IN PRINCIPAL CITIES***



*The New No. 400 General Concrete Cart*

# A New Concrete Cart

THE new No. 400 General concrete cart of the General Wheelbarrow Co., 3140 East 65th Street, Cleveland, Ohio, has been designed to overcome the weaknesses heretofore encountered in this item of equipment. The hopper is unbreakable. The sides are flanged around the bottom and ends, and welded. The angle steel reinforcing frame around the top is unbreakable, being lapped over and riveted together at every point.

The underslung axle is unconditionally guaranteed against breaking or bending. It is 1 5/16 inches in diameter, is made of chrome manganese steel, heat treated and temper drawn to a tremendous degree of toughness; and protected from wear by a renewable steel bushing.

The legs are provided with shoes. The handle is of steel pipe to prevent bending or breaking. The wheels have grease cups. There is a loop in front of the hopper for pulling the buggy up inclines. The standard cart has 40-inch wheels with convex tires, but can be furnished with 36-inch or 42-inch wheels. Optional, also, is the straight axle passing through the hopper. The cage roller bearings are optional.

# Patent Issued on Automatic Pivotal Axle for Graders

AN announcement of the issuance of a patent on July 7, 1928, covering an automatic pivotal rear axle as used on Galion E-Z Lift adjustable leaning wheel graders and registered as U. S. Patent No. 679803, has been received from the Galion Iron Works & Manufacturing Co., Galion, Ohio. It is claimed that this automatic pivotal axle takes care of certain forces on the rear end of the grader which heretofore have tended to cause the machine to slide sideways in certain kinds of road work. It automatically prevents the ditch wheel from cutting and crowding into the bank and thus spoiling the ditch. The effect of this automatic action is to guide the wheel away from the bank, thus leaving a clean ditch and this is all accomplished without any effort or attention on the part of the operator.

In explaining the mechanical principle of this invention the Galion Company states that the rear axle is attached to the main frame of the machine by two heavy parallel bars made of special cast steel. When adjusting the position of the rear axle in relation to the main frame the rear end of the main frame of the machine swings on two heavy wings attached to and being a part of these parallel bars, thereby causing the line of draft to remain practically the same on the rear axle, regardless of the position to which the machine is adjusted, wherein the shiftable rear axle which has been in use on graders for many years the point of gravity as well as the line of draft changes as the machine is shifted from one side to the other and the only time when the point of gravity or the line of draft is scientifically correct is when the main frame is shifted to the exact center of the rear axle.

These parallel bars are so attached and designed that as the machine is adjusted for work they cause the rear axle to be automatically thrown into a skew in the proper direction to overcome the offset pull load caused by the angle at which the blade is working, which, in connection with the leaning wheels to take care of the gravity load of the machine on the incline eliminates any tendency to side slipping or skidding.

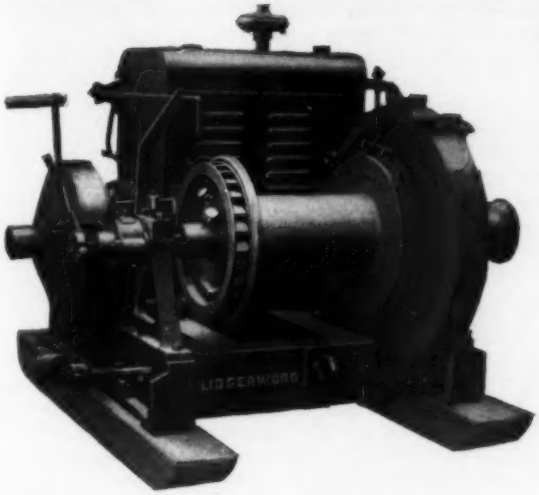
# Flood Light Attachment

A flood light attachment of new design for use with small tanks of dissolved acetylene, the same as are used for truck and tractor lighting, has been announced by the Prest-O-Lite Co., Inc., 30 East 42nd Street, New York. By the connection of the attachment a convenient, portable, powerful flood lighting unit is obtained which can be used for illumination in dark places and for facilitating night work of all kinds.

The attachment is of simple, strong, rigid and compact construction. Universal adjustment is obtained with only one swing joint, this minimizing the possibility of leakage. The attachment itself can be used as a handle in carrying the entire unit, because of the substantial construction of the new part and because of its position near the center line of the tank.

*The Prest-O-Lite Floodlight Attachment*

# Keep Building Materials Moving to Your Workmen



20-h. p., 3,000 lbs. at 190 f. p. m.
Drums—10" diameter, 18" long, 20" flanges
Single drum, Catalog No, 5120, weighs 3000 lbs.
Double drum, Catalog No. 5220, weighs 4000 lbs.

*Carried in stock for immediate shipment*

Given a ton and a half of dependable, independent hoisting power at a good speed, how much waiting time can you avoid each day on your work?

## THE LIDGERWOOD UTILITY 20

drives piles; hoists brick, mortar, lumber, stone, re-inforcing steel; spots, loads and unloads cars; drags a scraper through dirt, sand, gravel. It is a widely useful piece of contractor's equipment, with ample power and speed for the many hoisting and haulage jobs encountered in construction work.

**Lidgerwood Manufacturing Company**
**Elizabeth, New Jersey**

# ATLAS TRACTORS

— 4 —
WHEEL STEER
— 4 —
WHEEL DRIVE

**The ATLAS driver has no worries!**

Through mud, through water, through sand, through snow, the ATLAS plows its way without hesitation. Uphill, across ditches, pulling stumps or other heavy loads—through all kinds of adverse conditions—the ATLAS is on the job giving service that has no equal.

Breakdowns are almost totally lacking, owing to the absence of complicated parts. But if a breakdown should occur, there would be no need to worry, for parts are extremely simple and easily replaced.

*Shall we send you further information regarding this remarkable tractor?*

**ATLAS ENGINEERING COMPANY**

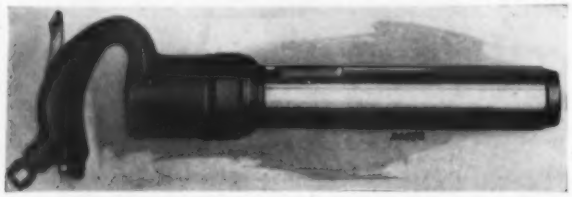
Box "N" — *Manufacturers of Bucket Elevators—Conveyors—Loaders—Etc.* — Branch Office

**Clintonville, Wisconsin** — **Milwaukee, Wisconsin**

# Riveting Hammers

A new line of riveting hammers, manufactured in four sizes with 5-, 6-, 8- and 9-inch strokes, has been brought out by the Ingersoll-Rand Co., 11 Broadway, New York. These hammers are high in power, easy to operate, and low in air consumption. Several improved features of construction insure reliable and economical service.

An outstanding improvement is the manner in which the handle is fastened to the barrel and kept tightly in place by a spring locking device. The handle is threaded on to the barrel and the spring lock not only prevents the handle from unscrewing but applies tension to automatically tighten it.



*The New Ingersoll-Rand Riveting Hammer*

The valve operates in a hardened and ground valve box located at the head of the barrel and clamped in place by the handle. The valve is exceptionally strong and durable, having large bearing surfaces and being free from any holes or ports from which cracks could start.

The valve box which houses the valve has a solid upper end which provides a positive compression chamber for the piston on its up stroke. It always acts to prevent the piston from striking the handle end as this air cushion is not dependent on an air-tight joint between the handle and the barrel.

The barrel of the hammer is made of special steel heat treated and ground to exact dimensions. An open type outside trigger handle is furnished as standard, but closed or inverted type handles can also be supplied.

# A Vertical Plunger, Dewatering, Pump Unit

DESIGNED expressly as a dewatering force pump, the PDFL-8 unit of the Domestic Engine & Pump Co., Shippensburg, Pa., is suitable for use on all dewatering work. It has an exceptionally high suction lift, and as the plunger gives a positive and uniform displacement, and is also rugged and strong, it is much better suited for working against moderate discharge heads than a closed diaphragm pump.

*The Domestic Vertical Plunger Pump Unit PDFL-8*

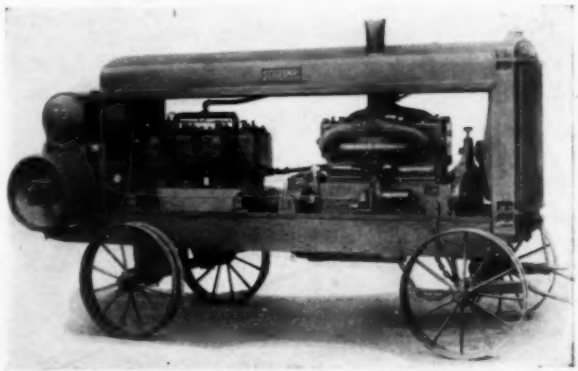
This vertical plunger dewatering pump is advantageous on all underdrainainage work, well point system, and on many open trench pumping jobs to carry the discharge water far away from the trench to prevent it from seeping back, since this often requires forcing it through a long line of pipe or hose or even over the spoil bank.

The double pump unit is fitted with manifolds having 4-inch pipe thread connections for both suction and discharge lines, but is so designed that each pump can be used independently with separate suction and discharge lines.

The unit is mounted on an all-steel truck, having 16-inch front and 22-inch rear wheels, and front axle equipped with "bail" type handle. The engine has a rated capacity of 5 to 8 horsepower. It has a displacement of 15,600 gallons per hour, a maximum suction lift of 25 feet, a maximum discharge head of 75 feet, and a maximum total head of 80 feet.

# 360-Foot Compressor

A recent addition to the line of air compressors manufactured by Schramm, Inc., West Chester, Pa., is a new 360-cubic-foot unit furnished both for portable and stationary installation. The compressor itself consists of a 4-cylinder vertical type unit with a bore and stroke of 7⅛ by 5 inches and a displacement of 360 cubic feet per minute when operated at 780 r. p. m. The engine used in connection with this compressor on the portable outfits is the heavy duty Buda type with a bore and stroke of 6x7⅛ inches.



*The New Schramm 360-Cubic-Foot Portable Air Compressor*

The compressor is completely equipped with air strainers on the compressor and engine, visible gasoline strainer, automatic slow down governor which immediately reduces the speed of the engine when the air compressor reaches a predetermined pressure or when the load is automatically thrown off the compressor. As soon as the load is again thrown on the compressor, the speed of the engine is again increased and the compressor then goes into action. This outfit is also equipped with a Schramm clutch, enabling the operator to start his engine independent of the compressor.

*Loading a Train of Tractor-Drawn Dump Wagons*

# Build Concrete Roads *Faster— and Better!*

**Amazing Results**

The Calcium Chloride method achieves results which are truly amazing.

In concrete highway building, 2 pounds of "3-C" Calcium Chloride to each 100-pound sack of cement produce more compression strength in 7 days than is obtained in 21 days by old methods.

**"3-C" Brand Calcium Chloride quickens the time of hardening, and increases the strength of concrete — saving time and labor.**

**Open a New Road in Half the Time**

The time-saving of the "3-C" method offers tremendous advantages—a new road opened in half the time—saving on detour maintenance—reduced labor cost, and many other similar savings.

Get complete information about "3-C" Calcium Chloride. Write for copy of our booklet on Curing Concrete.

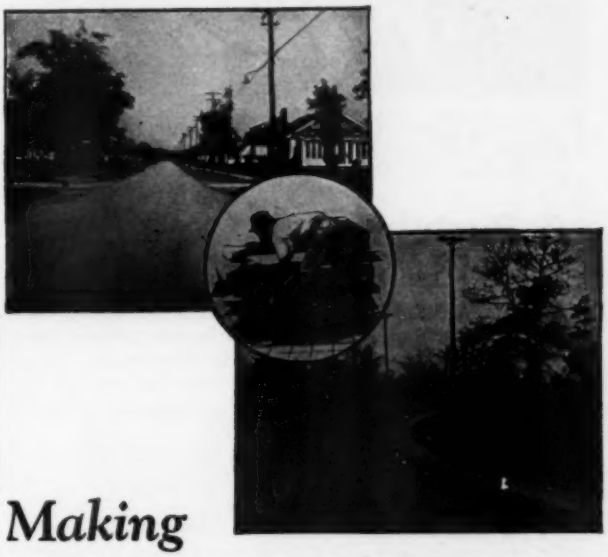
**If you are interested in Dust Prevention and maintenance of gravel roads, write for our booklet, "Conquering Dust."**

**COLUMBIA CHEMICAL DIV.**
**Pittsburgh Plate Glass Company**
**BARBERTON, OHIO**

# American Steel & Wire *Company's*

# WIRE FABRIC

*"The Steel Backbone for Concrete"*



## *Making City Street and Country Highway Permanent*

**TO reinforce concrete roads with Wire Fabric makes them permanent and is a proven economy. This fact is conclusively brought out in the report of the Highway Research Board, National Research Council.**

**Made of cold drawn high tensile strength steel, Wire Fabric has proved itself the perfect slab reinforcement. It gives the most effective distribution of steel—the closely spaced wires insuring greatest binding strength, holding the slab together as a solid unit and preventing the development of cracks.**

**Wire Fabric means permanent reinforcement—longer concrete life—lower maintenance costs. It is furnished in sheets cut to definite size which are easily handled and placed.**

**SALES OFFICES:**

| | |
|---|---|
| CHICAGO.....208 So. La Salle Street | NEW YORK.....30 Church Street |
| CLEVELAND.....Rockefeller Building | BOSTON.....Statler Bldg |
| DETROIT.....Foot of First Street | PITTSBURGH.....Frick Building |
| CINCINNATI.....Union Trust Building | PHILADELPHIA.....Widener Building |
| MINNEAPOLIS—ST. PAUL..... | ATLANTA.....101 Marietta Street |
| .....Merchants Nat'l Bank Bldg., St. Paul | WORCESTER.....94 Grove Street |
| ST. LOUIS.....506 Olive Street | BALTIMORE.....32 So. Charles Street |
| KANSAS CITY.....417 Grand Avenue | BUFFALO.....670 Ellicott Street |
| OKLAHOMA CITY..First Nat'l Bank Bldg. | WILKES-BARRE.....Miners Bank Bldg. |
| BIRMINGHAM.....Brown-Marx Bldg. | *SAN FRANCISCO.....Russ Bldg. |
| MEMPHIS..Union and Planters Bank Bldg. | *LOS ANGELES....2087 E. Slauson Ave. |
| DALLAS.....Praetorian Building | *PORTLAND.....777 Nicolai Street |
| DENVER.....First National Bank Bldg. | *SEATTLE....4th Ave. So., & Conn. St. |
| SALT LAKE CITY....Walker Bank Bldg. | *United States Steel Products Company. |

*The 40-Foot Model HBW Chicago Automatic Portable Belt Conveyor With Shaker Screen Separating Three Sizes of Materials and Delivering One Size to the Truck*

# A Portable Belt Conveyor with Shaker Screen

A PORTABLE belt conveyor with single and double deck shaker screen is being produced by the Chicago Automatic Conveyor Co., 1853 South 55th Avenue, Cicero, Ill. It is the Model HBW heavy-duty belt type conveyor for sand, gravel, crushed stone, etc. It has a capacity of 60 yards an hour and has many desirable features.

The non-clogging receiving end prevents the material packing around the receiving end roller. The belt, 18 inches or wider, is of 4-ply 1/16-inch rubber covered, and built to withstand the most exacting service. The guide belts are used to center the load in place of a steel flare, preventing the wearing of the main carrying belt. The electric motor or gasoline engine mounted over the conveyor prevents or does away with motor or engine troubles caused by falling material.

The entire length of the return belt is covered by steel plate, keeping the material from falling on the belt. The removable side plates are held in place by thumb nuts for quick inspection of the receiving end roller and scraper. The under side of the receiving end is steel encased against damage to the belt. The takeups are at the delivering end.

The yoke style wheel frame allows the conveyor to be lowered to the axle and elevated to its maximum height. The swivel axle with heavy-duty 4-inch tired wheels is standard equipment. The winch is of the steel worm gear and pinion type, with crank handle placed outside the wheel frame about waist high for easy operation. Ball bearing sheave wheels make raising and lowering easier. Alemite lubrication is used throughout. The ball bearing toughing idlers have six sets to each idler.

The automatic shaker screen is made with single and double deck, in all lengths and all capacities. It eliminates the necessity of installing a stationary screening equipment. The screens are so designed that they can be attached to any make conveyor in a short time. The power is supplied by means of a sprocket wheel on the delivery in end shaft of the conveyor This runs to a sprocket wheel on the screen, driven by a short chain. The sprocket wheel on the screen turns a specially-designed eccentric wheel which bumps the receiving end of the screen and which is so arranged that the agitation can be increased or moderated. On occasions when the gravel is wet, the agitation or movement of the screen working up and down can be increased to 1¼ inches. It can also be reduced to conform with the desired requirements. The agitation is regulated by a set bolt.

The double deck is used for screening three sizes, and both decks are agitated. The top deck, which is 7 feet long, is made with 18 inches of solid plate and as much screening surface is desired, up to 5 feet 6 inches. The lower deck is 4 feet long, and is made up of 4 feet of screen.

The single deck is used for screening two sizes of material. This is made with 18 inches of plate, 4 feet of screen and 18 inches of plate.

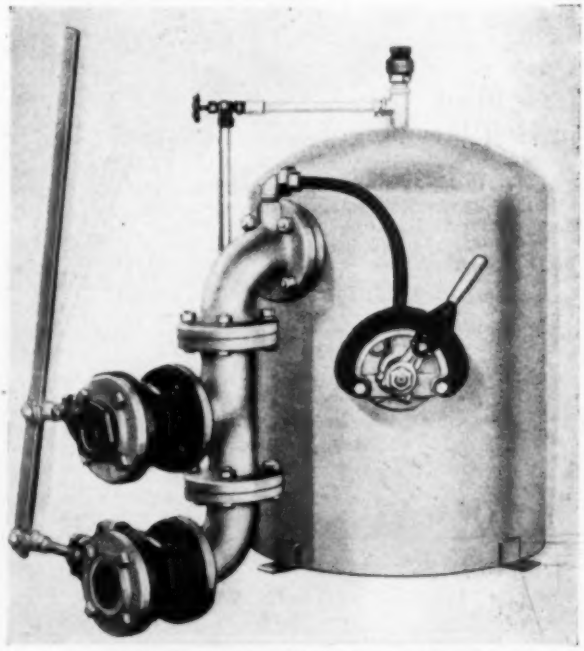
# A New Water Regulator

THE need for an accurate water tank in combination with a measuring device which would allow for quick setting and changes in the water cement ratio and quick allowance for the moisture contained in the aggregates of the mix, has been met by The Lakewood Engineering Co., Cleveland, Ohio. This new water regulator for the control of the water cement ratio in the modern concrete mixing plant consists of a tank which gives accuracy of discharge, batch after batch, for any given setting, and a measuring dial. The upper part of the scale is in gallons to conform to the water cement ratio and the lower scale is in pounds. A double pointer is provided on the lever so that a given setting of the tank can be read simultaneously in gallons and pounds. The regulator can be attached to any make of mixer in the field and gives an accurate and easily controlled tank.

The quick adjustment of this unit is an important feature. The change in the amount of water discharged is secured by the movement of a lever on a quadrant graduated both in pounds and in gallons; the lever clamps in position to the quadrant. Charge and discharge can be secured in a few seconds. Compensation for moisture in aggregates can be set off quickly on the graduated quadrant.

Complicated internal mechanism is eliminated. There are no intricate parts to move, adjust or replace. The gage lever is set, and the tank can be left alone.

Discharge is fast and continuous. There is no break in the flow with a long dribbling discharge. All tanks are equipped with a water glass, so that a visual check is always available of the automatic operation of the tank. Two clip valves are used, operated by one lever—one for discharge and one for inlet. The clip type valve has easily renewable seats. The hook up is so arranged that when one valve is open the other is closed. A balanced type piston valve can be furnished if desired.



*The New Lakewood Water Regulator*

Gasoline
Electric
Single Drum
Double Drum

STERLING HOISTS

with
Timken
Roller Thrust
Bearings and
Asbestos
Frictions

**Sterling Machinery Corporation**
General Offices 2303-7 Holmes St.
KANSAS CITY, MO.

"NATIONAL"
Power Block Machine

**NATIONAL**
**Concrete Block Machinery**
*For Hand Operation*
*For Power Operation*
Equipment for Every Size Plant
Highest Production at Lowest Cost
*Write us for literature and information*

**CEMENT BLOCK MACHINERY CO.**
*Office and Factory*
17 Durand St. Newark, N. J.

**The UNION No. 9 MIDGET HAMMER**

Designed to come within the weight range of the pavement breaker and the rock drill type of hammer, and at the same time do more work with less air consumption.
Weighs 97 pounds, delivers over 250 blows per minute and strikes a 275-pound blow.

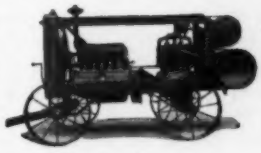
*Send for copy of new catalog No. 124 on "Pile Driving Machinery and Foundation Equipment"*

**UNION IRON WORKS**
*Builders of Double Acting Pile Hammers since 1906*
West Shore Siding Hoboken, N. J.

**Buhl**

**A variety of types and sizes to meet every portable compressor demand—Sold through reliable dealers and distributors.**

*Send for bulletin today*



**The Buhl Company**
*Manufacturers*
*General Office:*
405 S. Dearborn St.
Chicago

**Dependable Power**
in sizes ranging
in H. P. from
3 to 160

**Le Roi Company**
Milwaukee

**LE ROI ENGINES**
for dependable power!

**HONHORST TAR HEATERS**
*"Built for service"*
ALL STYLES
Portable and Stationary
25 to 200 gallons

See our page in Street Construction Section, Municipal Index, for the Kettle you need.

*Write for Pamphlet No. 15 on the New Oil Burning Heater*

THE JOS. HONHORST CO.
1016 W. 6TH ST. CINCINNATI, O.

*Aeroil* **ASPHALT HEATERS**

THE NEW AEROIL
ASPHALT KETTLE
*TRAILER*

RUBBER TIRES
LEAF SPRINGS
ROLLER BEARINGS

Melts and heats pitch or asphalt in one-half the time required for woodfires. Made in the following sizes: 25-50-65-75-100-110-150-165 gallons capacity.
Can also be had on legs and on wheels without rubber tires.
*Write for full particulars on type and size to meet your requirements*

**AEROIL BURNER CO., Inc., West New York, N. J.**

**STEEL SHEET PILING**
Bought.
Sold.
Rented.

**WEMLINGER INC.**
Service.
Technical advice.
Stocks on hand everywhere.

149 BROADWAY NEW YORK

*A Truscon Steeldeck Roof of the I-Plate Type*

# Insulated and Waterproofed Roofs

PARTICULARLY adaptable to theaters, gymnasiums, auditoriums, public halls and many industrial buildings requiring large floor areas free from supports and obstructions, the Steeldeck roofs of Truscon I-plates and Truscon Ferrodeck have been developed by the Truscon Steel Co., Youngstown, Ohio. These roofs are plates of copper-alloy steel of standardized lengths and widths, with ribs formed into them. The ribs are on the under side of the plates. The top is of a smooth level surface to receive insulation and waterproofing.

These roofs are light weight, non-combustible. When used on industrial buildings where the roof also serves as a ceiling, the under side of the roof presents a trim appearance and its painted surface is an effective light reflector. The "Steeldecks" provide a smooth, solid surface for applying any standard roofing material. The use of these Steeldecks eliminates any possible damage to the built-up roofing because of expansion and contraction. They cannot warp or shrink and there are no bulges or waves, protrusions, holes or open spaces to interfere with the proper construction of built-up roofing or cause breaks as the workmen walk over it. The steel decks provide an insulation of varying thickness to meet any internal or external conditions.

Lightness in weight is one of the features of this roof construction, which is not over 5 pounds per square foot, including insulation and waterproofing. Expansion joints are provided in two directions at the sides and ends of each plate. The use of the Steeldecks saves time in completion of buildings, espepecially in wet and winter seasons. It is scientifically correct and spans to 8 feet between supports, depending on the loading requirements. It is best for straightway, flat, pitched and curved roofs with a minimum radius of 40 feet.

The I-plate type of Truscon Steeldeck is a roof so formed that each sheet is a unit itself, capable of carrying loads between the members of the roof structure. The I-plates are manufactured of 18-gage and 20-gage steel sheets, with I-sections formed in the sheets longitudinally. On one outside edge a complete I-section is formed; on the other outside edge a return of about ½-inch is formed to fit down between the webs of the adjacent I-sections to give a smooth, finished surface.

The I-plates are applied directly over the members of the roof supporting structure, and are securely fastened by means of sleeve splice clips that telescope over the ends of the I-sections, and slip over the flanges of the members of the roof supporting structure, holding the roof securely in place.

The Ferrodeck type of Truscon Steeldeck roofs is an assembly of sub-purlins and reinforced roof sheets. The sub-purlins are made from 18-gage channel sections, spot welded back to back. A bend in the web of the channel section causes an opening to be formed between the backs of the channels at the top, when they are spot welded together.

The Ferrodeck roof sheets are fabricated with two edges flanged over about 1-inch at 90 degrees. Substantial reinforcing members, at intervals of not over 2 feet, are provided to strengthen and stiffen them. These fabricated roof sheets are either 18 or 20-gage.

To erect Ferrodeck the sub-purlins, at 2-foot spacings, are securely fastened to the supporting roof framing by means of spring clips. The fabricated roof sheets are placed over the sub-purlins so that the flanged over edges of adjacent sheets fit side by side, into the openings along the tops of the sub-purlins. The fabricated sheets are locked in place on the sub-purlins by bending the ends of reinforcing members under the top flange of the sub-purlins, making a smooth deck.

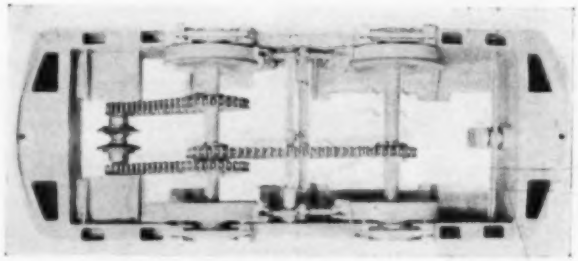
# Inequalities of Track Minimized

A cross-equalizer that minimizes the inequalities of track is one of the important features which the Geo. D. Whitcomb Co., Rochelle, Ill., has built into its line of gasoline locomotives. This cross-equalizer is not very common in gasoline locomotive practise, and is an outstanding improvement. In actual tests of the cross-equalizer on a 10-ton locomotive, the manufacturer placed a 2x4 on the track and the wheels of the locomotive passed over it without visibly tilting the floor of the cab. Since much of the work that contractors' locomotives are called on to do is on temporary track, the danger of derailment is minimized and the locomotives operate much more smoothly and efficiently by means of these cross-equalizers.

Whitcomb locomotives can be operated by anyone who is capable of driving and caring for a truck. They are built with fitted and machined that no side strain or stress has any effect a large margin of power such as will care for temporary overloads. All parts are designed with a wide margin of safety. All parts are arranged to afford easy access for maintenance or repair work. All parts are made to accurate fit, so as to be inter-changeable without expensive shop work.

With a short wheelbase, a minimum amount of overhang, a low center of gravity, and a high track clearance, these locomotives are adapted for narrow gage, construction work under the most adverse operating conditions. The various units are arranged much the same as in standard automobile design. The radiator is in front, with the engine just back of it. The clutch is housed in the flywheel of the engine. The transmission is just back of the clutch.

The engine has a hood covering similar to a truck hood, carefully designed so as to exclude grit and dirt. The cab is at the rear end of the locomotive. The open cab is standard equipment for locomotives ranging from 10 to 14 tons, but



*Frame of a Whitcomb Locomotive, Showing the Cross Equalizer Bar at the Right*

# EVERYWHERE

40 ft. 0 in. Portable Belt Type Conveyor equipped with shaker screen separating three sizes of materials and delivering one size into truck

## CHICAGO AUTOMATICS

Are cutting loading and unloading costs for thousands of contractors.

*Write for Descriptive Bulletins.*

**CHICAGO AUTOMATIC CONVEYOR CO.**

*Originators of the Portable Conveyor*

**1853 South 55th Avenue** **Cicero, Ill.**

*Manufacturers of*

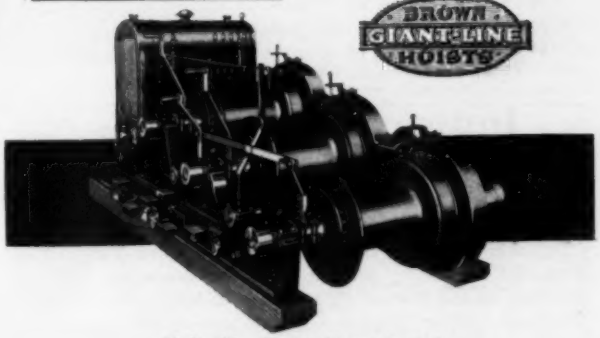
**Portable and Stationary Belt and Bucket Type Conveyors and Loaders—Shaker Screens**

***Agents in all principal cities***

Alemite-Zerk High Pressure Lubrication to all Bearings, including both Bronze Bushings in the Drums. No need to stop Motor to Lubricate any Bearing.

# 1 STANDARD DESIGN 8 SIZES 4 TO 40 HP

BROWN GIANT-LINE HOISTS



*Valuable Hoist Manual and Catalog "G" upon Request*

**THE BROWN CLUTCH CO.**

**Sandusky, Ohio, U. S. A.**

HOIST SPECIALISTS FOR MORE THAN TWENTY YEARS

WELL DRILLS AND EXCAVATORS

TRADE MARK **KEYSTONE** REGISTERED U. S. PATENT OFFICE

KEYSTONE DRILLER CO., BEAVER FALLS, PA.

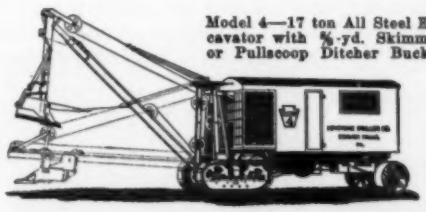
A LIGHT, gas drive, traction shovel, useable with 3 different interchangeable scoops —Skimmer, Ditcher and Clam Shell— for Road Grading, Trenching, Back-filling, Cellar Digging, Pit Mining, Loading, Unloading and Handling Materials. Crawler-mounted. Steam or electric power if desired.

Saves first cost, moving cost and upkeep, and is readily sold or rented for any sort of excavation job. A reliable road shovel and trenching machine of remarkable adaptability to other uses.

**Digs More for a Dollar**

## KEYSTONE DRILLER CO.

**BEAVER FALLS, PA.**



Model 4—17 ton All Steel Excavator with ⅝-yd. Skimmer or Pullscoop Ditcher Bucket

# Wire Cable Whipped and Cut in less than 1 minute

**The Starrett Steel Band and Cable Cutter**

**(a kit tool) is a new method for binding and cutting any grade of wire cable —up to one inch.**

**Takes a minute and leaves steel sleeve on the end of the cable. No frayed ends or torn hands.**

*Write for prices and details*

**MORSE-STARRETT PRODUCTS CO.**

**1916 Broadway,** **Oakland, Calif.**

a completely enclosed cab can be furnished when desired. For the 16-ton locomotives and all larger sizes, the enclosed cab is standard. The transmission is beneath the center of the cab, and the shift, forward and reverse levers controlling the transmission are placed conveniently for the operators. All frames are of exceptionally heavy cast section, and are so fitted and mechined that no side strain or stress has any effect on them.

The frames are carried on heavy springs of the semi-elliptical type. The locomotives are full spring mounted. The cross-equalizer consists of a crossbar pivoted through the front of the frame and acting on each front spring through a side lever. This gives the locomotive a 3-point suspension, and a constant equilibrium.

The engines used on the Whitcomb narrow gage 10 to 30-ton locomotives vary in kind and size, according to the size of the locomotive. All of them are of the heavy-duty industrial 4-cycle water-cooled type.

# Improved Acetylene Generators

THREE medium-pressure-type acetylene generators for welding and cutting have been developed by the Oxweld Acetylene Co., 30 East 42nd Street, New York. The Type MP-2 medium pressure acetylene generator, built in two sizes having 50- and 100-pound carbide capacity, replaces the earlier medium pressure acetylene generator of this manufacturer, while the 300-pound capacity is entirely new. These three generators are suitable for supplying pressure-type or medium pressure welding and cutting blowpipes.

The feed mechanism of the Type MP-2 generator has been redesigned to make the carbide shut-off even more positive than formerly. A new method is used to stop the carbide feed positively in case the diaphragm breaks or zero pressure exists in the generator.

A new regulator, the Type R-40, is furnished instead of the line regulator formerly used. This regulator is of the stem type, having a large stem and seat to provide ample capacity, and is equipped with two gages. One of these indicates the pressure in the generator and the other the pressure in the delivery line.

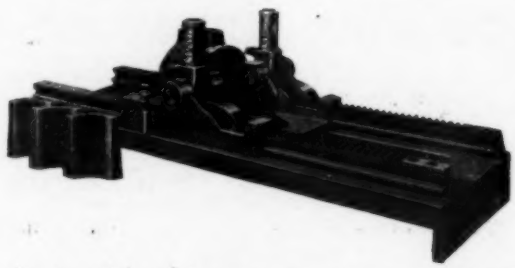
The hydraulic back pressure valve, which has been simplified, and the filter are of seamless steel tubing assembled by bronze-welding and then galvanized, making for sturdy construction. The vertical pipe, leading downward to the back pressure valve and extending below the surface of the water, is fitted with an angle check valve. In case back pressure is exerted, water will be forced up the vertical pipe causing the check valve to close and preventing the possibility of back pressure or flash reaching the interior of the generator.

*One of the New Oxweld Acetylene Generators*

The two relief valves, one mounted on the hydraulic back pressure valve and the other direct-connected to the generator, are of new design, have larger capacity and are less liable to leak than the old devices. One of the desirable features is interference levers which unseat the relief valves every time the generator is recharged. This arrangement automatically prevents the relief valves from sticking, should they be called on to function. Since the relief valve on the hydraulic back pressure valve opens only momentarily, no acetylene from the line is lost during recharging.

With the more sensitive feed and comparatively close regulation obtained by means of the large capacity, Type R-40 regulator, a higher constant delivery pressure is available than with the earlier model generator. The relief valve should be set to blow off at a pressure not higher than 15 pounds per square inch.

The Type MP-3 medium pressure acetylene generator meets the demand for a pressure type generator of large capacity that will supply gas with a minimum pressure fluctuation and with the minimum expense for maintenance. The same principle of carbide feed that has been used in the Oxweld balance seal generator, is used in the Type MP-3. The feed is driven by a motor actuated by a weight. A diaphragm pressure control is used in connection with the motor to regulate the feed and maintain proper pressure in the generator. The hydraulic back pressure valve is so arranged that it is always filled with water before the generator itself is entirely filled.



*The Simplex Pipe Pushing Jack With Three Tapered Jaws Standing Alongside*

# Jacks for Pushing Pipe Underground

PUSHING water or gas pipe, or pipe for electrical service or for oil heating supply, under paved streets or alleys, or under gardens or lawns, irrespective of temperature conditions, has been made possible by Templeton, Kenly & Co., Ltd., 1020 South Central Avenue, Chicago, Ill., by the development of Simplex pipe pushing jacks. The pipe is gripped by jaws in the center of the jack, and one or two men operating each of the two levers cause the pipe to be pushed through the ground powerfully and accurately.

These Simplex jacks are built in two sizes; the No. 332 for pushing pipe of ¾ to 2 inches in diameter, and the No. 334 for pushing pipe of 2 to 4 inches. One of the outstanding features of this new tool is that each size of pipe requires a set of jaws to conform to the size of pipe, and by which the crushing or distorting of the pipe is avoided. The average time required to push a 3-inch pipe through 25 inches of solid soil is between five and six minutes, using two men on each of the two levers, or approximately 23 man-minutes, which time also included resetting the pushing or traveling portion of the jack.

After the pipe has been pushed in the soil for approximately 25 inches, it is necessary to release the tapered jaws by tapping with a hammer on the releasing block, in order to slide the carriage or pawl mechanism back to the opposite extremity.

## Six State Projects Let in New Mexico

ON September 19 the New Mexico Highway Department opened bids on six road and bridge projects consisting of crushed rock surfacing on one job, grading, drainage and structures on a mountain job, concrete paving in the south of the state and two bridges, one in the northwestern corner of the state and one near the Zuni Indian reservation.

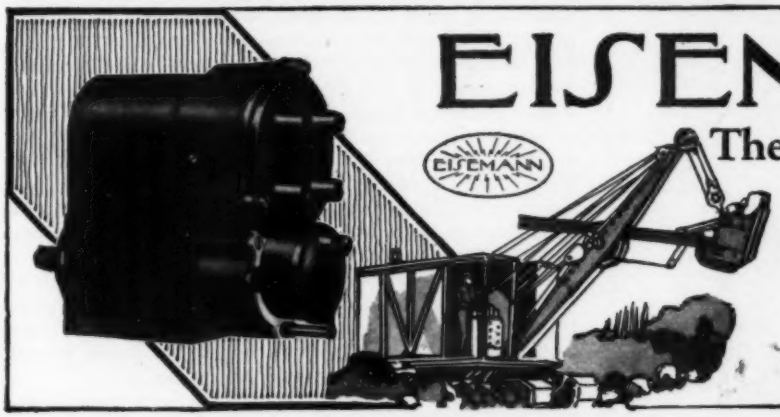
## 52 Tons Over Rough Mountain Roads

FIVE trucks were required to propel this 52-ton transformer over mountain roads, yet the 28-ton Rogers Trailer withstood the enormous overload without the slightest difficulty.

Rogers Trailers are built to withstand the severest service, to be propelled at high speed, to steer easily and to serve satisfactorily for years to come with the lowest known tire upkeep expense.

*Our new catalog gives all the facts*

**ROGERS BROTHERS CORP.**
**108 Orchard St., Albion, Pa.**



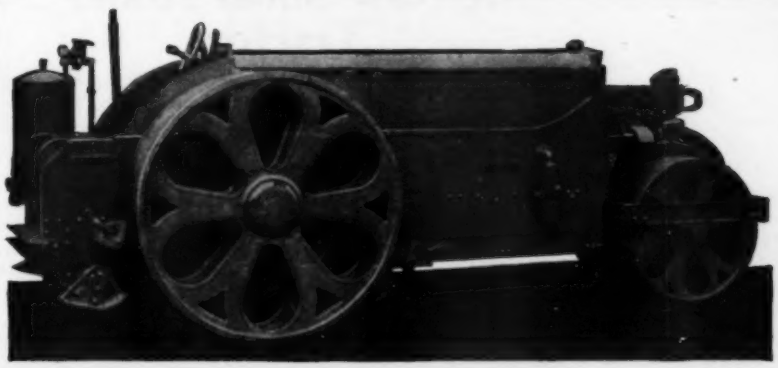
# EISEMANN

## The Foremost Magneto

*for Construction Equipment*

The overwhelming choice of the builders of high quality equipment. Favored by contractors everywhere.

EISEMANN MAGNETO CORPORATION
165 Broadway New York



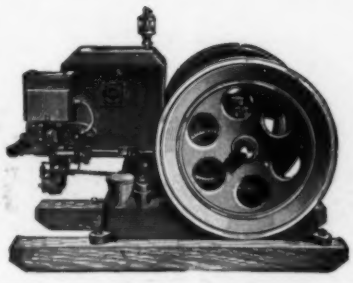
# HUBER

**4-CYLINDER**
**MOTOR ROLLERS**

Powerful and dependable, quick in action, economical to operate. Made in 4 sizes (5-7-10-12 tons). Send for Huber Motor Roller Catalog.

**The Huber Mfg. Co.**
**330 Center St. Marion, O.**

# STOVER ENGINES



## Most Dependable Power for Industrial Machinery

Power that is both dependable and economical is vital to the satisfactory operation of industrial machinery, all contractors agree. That's why more and more manufacturers specify Stover Good Engines—because of their proved superiority. 2-hp. size pictured at left. All sizes Wico-magneto-equipped.

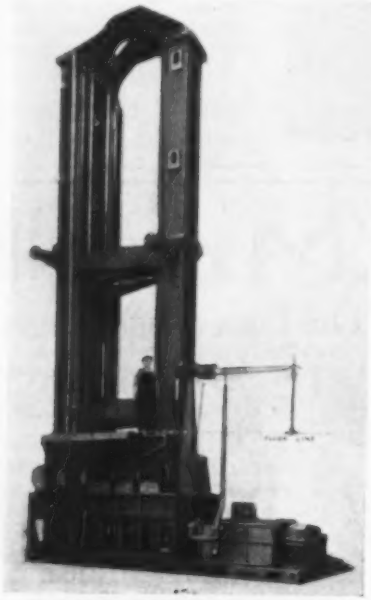
## 35 Years of Engine Building Experience

For almost half a century Stover engines have been famous for their in-built quality. Users testify they are better today than ever before. Service stations located everywhere. Write us for FREE literature describing the full line.

**STOVER MFG. & ENGINE CO.** 15 Lake Street FREEPORT, ILL.

# A Cable Testing Machine for the New Hudson River Bridge

A TESTING machine of a size sufficient for the purpose of testing the wire rope and cables to be used in the construction of the Hudson River Bridge between upper Manhattan, N. Y., and Fort Lee, N. J., has been designed by Riehle Bros. Testing Machine Co., 1424 No. 9th Street, Philadelphia, Pa. This largest universal testing machine in the world is capable of exerting a pull of 2,000,000 pounds, and is already located in a specially built laboratory building at the John A. Roebling Sons Co. wire rope and cable plant at Trenton, N. J., where it is being used daily for carrying out tests in conjunction with that company's research and inspection work on the new cables. The capacity of the machine is sufficient to pull apart a bar of structural steel nearly 6 inches square, or to crush a cast iron column 15 inches in diameter and 15 feet long with 1¼-inch walls. At full motor speed the pulling head may be operated at speeds of 10, 2, 0.5, and 0.1 inch per minute, while at slow motor speed pulling speeds of 5, 1, 0.25, and 0.05 inch per minute are available.



*The Riehle Machine for Testing Wire Rope and Cable of the New Hudson River Bridge*

With 3,500 feet intervening between towers, the Hudson River Bridge will have a main span suspended over water that will be twice the length of the main span of the Delaware River Bridge, now the suspension bridge with the longest single span in the world.

A very essential part of the straining mechanism of the new machine is the upper or stationary head, which is held in position by pins or keys passing through slots in the columns. There are three sets of these slots, thus giving the operator the choice of three different positions of the upper head. The operation of changing the position of the head is greatly facilitated by a device which withdraws or forces in the key by means of a screw and handwheel. The adjustable head is raised or lowered to the desired position by the moving head, while the keys and their respective operating apparatus are handled by the crane which serves the machine.

The pulling head is moved up and down as desired by three pulling screws turning in manganese bronze nuts forced into the head and held in place by keys and lock-nuts. The two heads are steel castings, 24 inches thick and weighing nearly 25,000 pounds each. They are pierced by rectangular cored slots to permit the specimen to pass through, while the lower surface of the pulling head and the upper surface of the fixed head have machined T-slots to permit the attachment of suitable tools or fixtures for various types of specimens. The customary wedge grips are not employed in this particular design.

There are three pulling screws, one of which is 11½ inches in diameter, 38 feet 4⅝ inches long and weighs 13,620 pounds. This screw sustains a load of 1,000,000 pounds at full capacity. The other two are 8½ inches in diameter of the same length as the front screw and weighing 7,470 pounds each. They sustain a load of 500,000 pounds each at full capacity. The screws are rotated by a train of gears.

The speed change gears and friction clutch assembly are all mounted in a cast iron box as a separate unit bolted to the base of the machine. A selective gear change is a unique feature of this portion of the design. Power is derived from a 75-horsepower Reliance 800-1,600 r. p. m. adjustable speed motor transmitting through a Link-Belt silent chain drive.

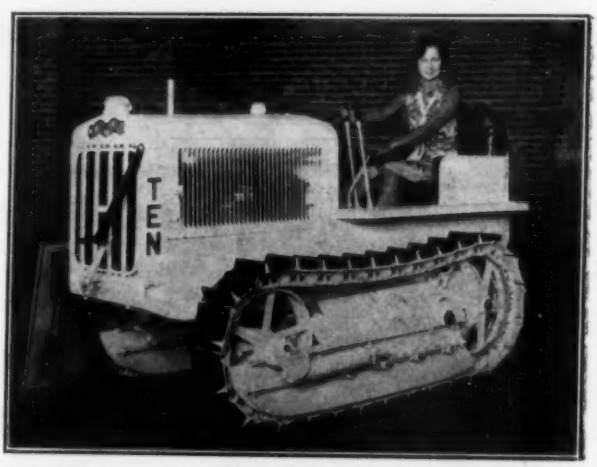
In the weighing system the table is a one-piece steel casting 13 feet long by 11 feet 1 inch wide on its upper surface and weighing 48,850 pounds. At full capacity it sustains the total load of 2,000,000 pounds, which it in turn transmits to the lever system on hardened steel knife edges. These are designed for a unit load of 10,000 pounds per linear inch, so that the total length of the knife edge is in excess of 200 inches.

The entire machine weighs about 275,000 pounds, and is 42 feet 10¾ inches high. Its extreme width is 13 feet and its length 21 feet. The maximum length of specimen which can be tested is 25 feet, while the clear space of 75 inches between the screws provides ample room for large pieces.

# A New Small Model Tractor

A small crawler tractor weighing approximately 4000 pounds and known as the Caterpillar Ten, has been announced by the Caterpillar Tractor Co., San Leandro, Calif., for production and sale early in 1929. The Model 10 was first shown on September 1 at the California State Fair at Sacramento, Calif.

This new model offers 10 horsepower at the drawbar and 14 horsepower on the belt. The engine bore and stroke are 3 ⅜ and 4 inches, respectively, and the engine speed 1500 revolutions per minute. From the tip of the starting crank




*The Daughter of Gov. Young, of California, Demonstrates the New Caterpillar Ten Tractor*

# DIXON'S *fingerprints*

*written in* FLAKE GRAPHITE

*for more than 100 years*

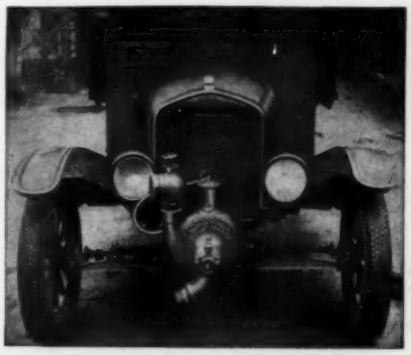
If you have never had the *how, where,* and *why* of Dixon's Flake Graphite lubrication explained to you, write for it today. Or, better still, send us an outline of your lubricating problems and we'll tell you how Dixon's can help you.

And, another word that is closely linked with these two is—*lubrication.* These three are inseparably linked in the minds of thousands of mechanics, maintenance men, and engineers, for unquestionably *Dixon's Flake Graphite* has its place in every well planned scheme of lubrication, and as an auxiliary lubricant with oils and greases it is generally recognized as benefiting the base lubricant.

This is the identifying mark of *Dixon's . . . Graphite.* The combination, *Dixon's* and *Graphite,* have been synonymous all over the world for more than 100 years.

**Joseph Dixon Crucible Company**

Jersey City D X N New Jersey



## Direct-Driven by Car or Truck—Automatically Primed—Low Priced

KEEP your ditches dry—do all kinds of pumping with a Barton. This pump attaches to the front of any make or model car, truck or tractor and is operated from the motor crankshaft—no separate engine required. It is automatically primed, and stays primed without attention. Built in five sizes. The Barton will save you time and money—eliminate lots of grief. Write us today.

AMERICAN STEAM PUMP COMPANY
BATTLE CREEK, MICHIGAN

# BARTON
PORTABLE PUMP

## MAKE BIG MONEY
## With Little SULLIVAN Hoists

How much money could you make with a 345-lb. portable hoist that would lift a ton or pull a 50-ton car? That's the SULLIVAN "Turbinair." Use it for hoisting materials, placing structural steel and stone, operating derricks, or pulling drag scrapers. Air, or electric power.

***Write for the picture book "Handy Hoisting and Hauling"***

# SULLIVAN
## MACHINERY COMPANY

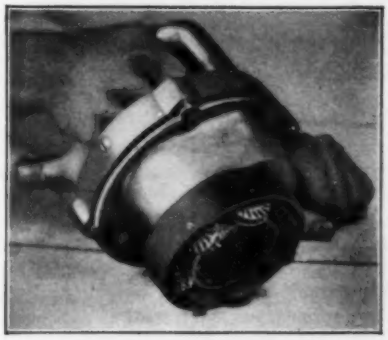
**162 S. Michigan Ave. Chicago, Ill.**

***Branches and Dealers in all principal cities***

## FINISH YOUR CONCRETE BEFORE COLD WEATHER

With this little Concrete Surfacer you can get any finish desired more quickly than by any other method.

***Can ship immediately from stock***



**TURBIN-AIR SURFACER**
**Weight with Stone, only 9 Pounds**

***Write for booklet and prices***

## THE TOUSLEY TOOL CO.

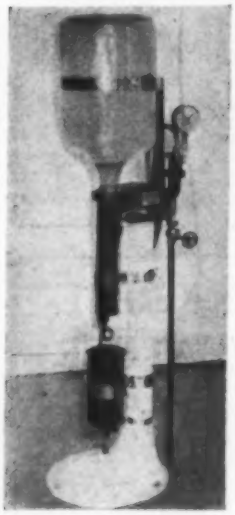
**1965 East 66th Street, N. E. Cleveland, Ohio**

in front to the rearmost point of the drawbar, it measures a fraction less than 100 inches in length. Measuring from the outer edges of the tracks its width is less than 4 feet. The radiator cap, the highest point of the tractor, is approximately 51 inches above the ground.

The Ten follows in general the principles of Caterpillar design. It is steered by engine power through individual steering clutches and individual brakes, permitting quick short turns and full power on the turns. It has the highly developed features of protection against dust and dirt, air cleaner, oil seals, a carefully worked out lubrication system, extensive use of heat treated and wear-resistant steels.

# New Equipment for Sterilizing Construction Camp Drinking Water

A NEW device for the application of prepared chlorine solutions and other chemical solutions in small amounts for the sterilization of drinking water, swimming pools, and small sewage systems, has been developed by the Paradon Manufacturing Co., Arlington, N. J.



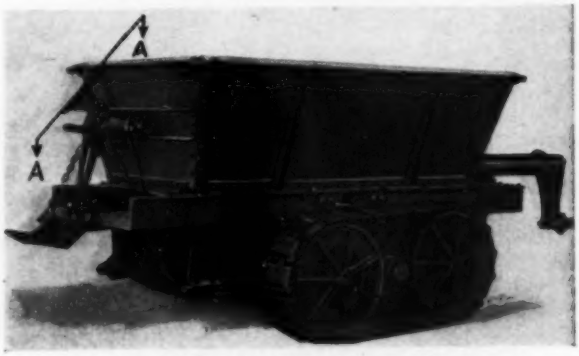
*The New Paradon Chlorinizer*

The prepared chlorine solution is contained in an inverted 5-gallon carboy. The partial vacuum in the top of the inverted carboy maintains a constant level of solution in a small reservoir known as the pump chamber located beneath the carboy. A second chamber, called the syphon chamber, is intermittently emptied by an automatic syphon operated by a small auxiliary water supply. This syphon chamber is connected by a meter tube with the pump chamber. When the syphon chamber is emptied a constant volume of air is trapped in the meter tube leading to the first reservoir. As the syphon chamber fills, this air is forced into the pump chamber. It displaces a corresponding volume of solution from the pump chamber, forcing this solution out through an overflow into the syphon chamber.

From the syphon chamber, water, plus the chemical, is discharged into a chamber designated as the rate controller. The purpose of the rate controller is to maintain a uniform discharge of the chemical solution, as the inflow to the rate controller is intermittent. The rate controller also acts as a water seal to prevent air from being admitted to the system into which application is to be made.

The solution ordinarily flows by gravity from the rate controller to the point of application. If, however, the desired point of application is under a pressure sufficient to render gravity flow impossible, an injector is used, drawing the solution from the rate controller and discharging it at the point of application.

The Paradon Chlorinizer is an automatic diluting device. The amount of chemical applied depends upon the strength of the primary solution, on the number of pulsations of the syphon per unit of time, and on the size of the meter tube. It is designed especially to apply small dosages of the prepared chlorine solution. There is practically no minimum dosage, as the concentration of the primary solution can be as small as desired. For any given meter tube the maximum capacity is approximately five times the minimum. Meter tubes of various capacities can be used. The Chlorinizers have been constructed with meter tubes having as small a capacity as five gallons in 14 days and as large a capacity as 5 gallons in six hours. At maximum operation the syphon requires about 200 gallons of water per 24 hours for operation, while the minimum requirements are about 50 gallons of water per 24 hours, and the water supply need not be under pressure.




*The Euclid Light Draft Crawler Wagon*

# Light Draft Crawler Wagon for Earth Moving

A crawler wagon especially light in draft has been designed by the Euclid Crane & Hoist Co., Euclid, Ohio. The creeper wheels used have the same track surface and general dimensions as those used on wagons of 30 per cent greater gross weight. A Caterpillar Thirty will handle one wagon and a Sixty will pull two or three wagons in a train.

The frame and drawbars of the Euclid wagon have been designed to give an ample factor of safety with maximum heaped loads. The arch-type front drawbar allows the tractor to undercut in turning and thereby reduces the turning radius. The wagons in train track closely even in turning short under shovels.

The rear end door control enables one wagon dumper to handle a 2- or 3-wagon train. The doors swing open under the center axle so that the load may be discharged both to the front and rear. The manufacturer states that, under good conditions, a Caterpillar Thirty pulling one wagon of 6-cubic-yard capacity will haul 40 cubic yards per hour on a haul of 500 feet when loaded under heavy cutting by a 1- or 1¼-cubic-yard shovel. A Sixty and three wagons will handle 45 to 55 cubic yards per hour on a haul of 1,000 feet. The 2- and 3-wagon trains may be handled with great flexibility. Wagons may be dropped or added to suit ground conditions, character of load and length of haul.

The wagon body is of 3/16-inch steel plate stiffened with steel angles and steel corner gussets. The doors are made of ⅜-inch plate reinforced with steel channel and angle sections. Each individual door has four steel hinges. Holes are provided in door plates so that oak plank can be attached for shovel loading in heavy rock work. The wagons are made in 5½- and 6-cubic-yard capacity.

## Well Point Drainage Used on Large New York Excavation

EXCAVATION work started early in September on what is to be the largest telegraph building in the world, to be located in the block bounded by Hudson and Thomas Streets, West Broadway and Worth Street. The well point system of drainage is to be used to facilitate excavating. This is said to be the first time that the well point system has been used in New York City although it has been used previously in other seaside cities.

# Put DOWFLAKE right in the Mixer

*Dowflake*, added right in the mix in the form of a solution, does away with the extra labor and expense of earth covering, and results in a faster-setting, more uniformly cured slab. It makes concrete more plastic, easier to spread and finish, and reduces the tendency toward surface cleavage, voids and pitting.

*Dowflake* has been proven practical—it saves time and money.

*Dowflake* is packed in handy waterproof 100-lb. bags.

THE DOW CHEMICAL COMPANY
MIDLAND · · MICHIGAN

*Branch Sales Offices:*
90 West St. · New York City
Second and Madison Sts., Saint Louis

Send for *free* book "How to Cure Concrete."

**"See the Dow Display at the Road Show, Cleveland, Jan. 14th to 18th."**

## See it at the next ROAD SHOW

**(Week of January 14th at Cleveland)**

Used the world over for roads, parks, cemeteries, golf and airplane landing fields, digging cellars, grading around new schools, laying out allotments, filling trenches, etc., this earth-moving tool has been found to be:

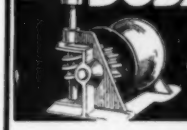
**Labor-saving** (one-man-operated)
**Handy and easy to run** (loading and dumping, spreading and leveling, are all handled from the driver's seat—and there's nothing to oil or adjust)
**Low in upkeep cost** (parts are few, strong and simple)
**Four sizes: scraper widths, 4, 5, 6, 7 feet**

## The Gustav Schaefer Wagon Co.

**4180 LORAIN AVENUE CLEVELAND, O.**

Schaefer Automatic One Man Tractor Scraper
*An Earth Moving Tool On The Market Since 1921*
All Operations by Tractor Power Control from seat while Tractor is in motion

## DOBBIE EQUIPMENT



*All kinds of Derricks*
*Agents in Principal Cities*
The Mundy Sales Corporation
30 Church St., New York

## National Distributors for the DOBBIE Steel Full Rotating Derrick

**TO JOBBERS AND DEALERS**

A full line of timber derrick fittings and hand winches is kept in stock at the factory at Niagara Falls, New York, for immediate shipment.

***Catalogs upon request***

## The Mundy Sales Corp.

**30 Church Street New York City**

**7-10**
**3½-5**
**Sizes**

**Tilting and Drum Types**

**Catalogs Ready on New**

## REPUBLIC ROLLER BEARING MIXERS

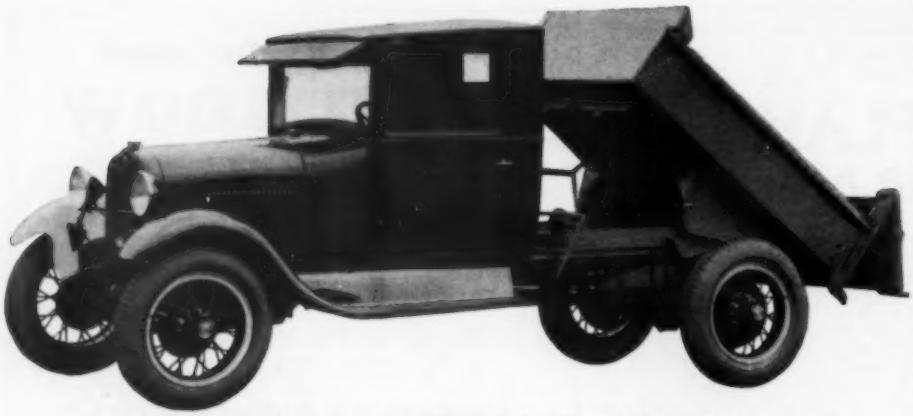
**New Features and Improvements**

**ALL MONEY SAVERS**

**Roller bearings throughout — heavier drum, trucks, frame and wheels—simplified construction—quicker mix and discharge—easier cleaning.**

***Write for Catalogs Today***

**REPUBLIC IRON WORKS**
**Tecumseh, Mich.**



*The New Lee Automatic-Gravity Dump Body with Model AA Ford Truck*

# Automatic-Gravity Dump Body for Ford Chassis

THE announcement of a new feature certain to be highly valuable to contractors comes from the Lee Trailer and Body Co., Plymouth, Ind., of their new automatic dump body for the Model AA Ford truck.

These new gravity bodies are fully automatic and may be operated from inside the cab or from the ground. The tailgate opens and closes automatically. When released for dumping, it opens, deposits the load, and closes tight every time when the body is returned to its original carrying position. It does not need to be pushed back to lock it. The body is proportioned to fit the chassis with the lowest center of gravity and lowest loading height.

The 3-point suspension makes it flexible and easy on the truck chassis and with the short overhang back of the rear axle, results in the proper load distribution from rear to front axle. Thus the truck can carry heavy loads over rough roads with perfect ease and balance.

These bodies are made in eight different styles to meet a variety of needs. The capacity ranges from 1 cubic yard to 1⅞ cubic yards, without side boards and from 1½ cubic yards to 3 cubic yards with sideboards. The units are sturdy and durable and will serve to solve many haulage problems.

# A One-Man Concrete Highway Surfacer

A concrete highway surfacer for cutting down high spots, surface irregularities, uneven expansion joints and repaired patches, and producing a surface as even as a billiard table, has been produced by The Concrete Surfacing Machinery Co., Dept. F, 4669-71 Spring Grove Avenue, Cincinnati, Ohio. Only one man is required to operate the "Berg" surfacer, and the manufacturer claims that it will do the work of ten men using other methods. It eliminates the use of expensive equipment and large working crews, is equally effective on new or old roads, and surfaces pebble, furnace slag, broken limestone and traprock aggregates.

This machine is of simple, sturdy, all-steel construction. It pivots on the rear wheels, with a side swing movement of the handle by the operator, whose only duty is to move and guide it. The side swing movement of the handle causes the cutters to shave away all projections evenly. The 1,200 r. p. m. of the cutter chuck and cutter plate, plus the spinning of the cutter wheels, carry the weight of the front section, relieving the operator of all tiresome lifting or applying of pressure. Two iron wheels at the rear of the chassis and a swivel caster in front provide a means for easily moving the machine from place to place.

The cutting tool is connected with an air-cooled gas engine by a uniflex coupling and operates through hardened beveled gears which run in oil. Shafts and gears are carried on Timken roller bearings.

The cutters are 2 inches in diameter and 3/16 inches wide. They are made of high grade steel, hardened by a special process, machine milled and 18-star pointed. These cutters contact with the road surface at great speed during the 1,200 r. p. m. of the 8-inch cutter plate, grinding the surface by cutter action contact. It is unequaled for rapidity and area of surface finished.

*The "Berg" Highway Surfacer*

The complete machine is 3½ feet long, and is mounted on a steel chassis. The total weight is approximately 250 pounds. A "roughing" cutter plate and a "finishing" cutter plate assembled with 12 and 16 cutters respectively with washers are supplied with each machine; also tools, Alemite grease gun, etc.

---

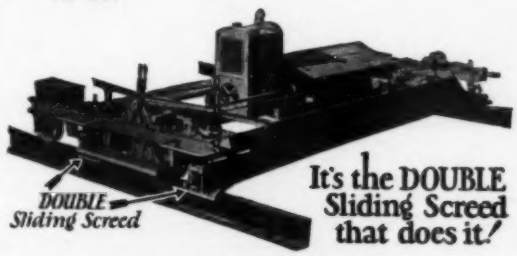
*Superior Batchmeters at the Plant of the Chillicothe Sand and Gravel Company, Chillicothe, Ohio. This Installation Is Made in Combination with Neff and Fry Concrete Stave Silos*

## ORD Concrete Road Finisher

**Rugged in Construction**
**Double Sliding Screeds**

**Finish Always Perfect**
**Insures Prompt Acceptance**
**Needs Little Attention**
**Increases Daily Yardage**
**Simple in Design**
**Handles Easily**
**Endorsed Everywhere**
**Roadbuilding Made Easier by Its Use**

May be adjusted for an extra foot of road either side or two-foot width over all




It's the DOUBLE Sliding Screed that does it!

*Send today for complete descriptive literature.*

**A. W. French & Co.**
*Manufacturers of the ORD Concrete Road Finisher*
**8440 Lowe Ave.** **Chicago, Ill.**

# BAKER

**ONE-MAN AUTOMATIC**

## ROTARY SCRAPERS

**Larger capacity—increased yardage. Automatic draft control permits continuous operation. No stopping. Narrow replaceable cutting edge cuts upkeep costs. Four sizes for any tractor—capacities 13 to 40 cubic feet.**

***Send for Bulletin No. 256***

**The Baker Manufacturing Co.**
**585 Stanford Ave.** **Springfield, Ill.**

# STANDARD

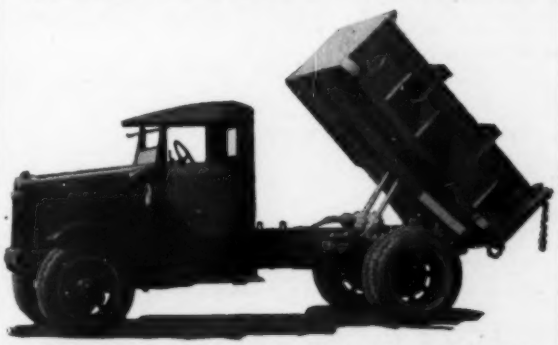
## *Asphalt Products*

Standard Asphalt Binder A *for surface treatment*
Standard Asphalt Binder B *for penetration work*
Standard Asphalt Binder C *for the mixing method*
Standard Cold Patch Asphalt *for repairing all types of bituminous road surfaces*
Standard Refined Asphalt (Socony Brand) *for sheet asphalt paving*
Standard Asphalt Joint Fillers *for brick or block pavements*
Standard Paving Flux, Standard Bridge Asphalt and Preserving Oils

SOCONY ASPHALTS AND ROAD OILS

**STANDARD OIL CO.**
**OF NEW YORK**
**26 Broadway**

## Rapid Delivery with HEIL HYDRO HOISTS



Will your present dumping and hauling equipment permit you to finish your fall contracts on time? Past experience has proved to many contractors that an additional Heil-equipped truck purchased at this time enables them to keep their schedules and actually make greater profits. Heil Hydro Hoists are the fastest hoists on the market and Heil Bodies are sturdily built to give long years of service.

***Write for complete information***

**THE HEIL CO.**
**1242-60 26th Ave.** **Milwaukee, Wis.**
***Manufacturers of Dump Bodies, Hoists and Tanks***

# Help for Contractors

These especially selected catalogs and pamphlets of value to contractors are for free distribution. You will find it worth while to check these lists each month and write for the catalogs you need.

**UP-TO-DATE ROAD EQUIPMENT**
Road rollers that are the last word in present-day construction and application, that are designed to meet all sorts of conditions, and are built in many models and sizes, are described in illustrated literature of The Buffalo-Springfield Roller Co., Springfield, Ohio.

**A NEW 2-YARD SHOVEL**
A full 2-yard capacity machine, the K-55, that is a powerful heavy-duty all-purpose unit, designed for adaptations with shovel, dragline, clamshell bucket and trench shovel, and that has many desirable and important features of construction, is described in illustrated literature which the Link-Belt Co., 300 West Pershing Road, Chicago, Ill., will be glad to send to interested contractors and engineers on request.

**AN ECONOMICAL AND EFFICIENT AIR COMPRESSOR**
Economy, efficiency and durability are but a few of the features of the Type 90-C air compressor of The Buhl Co., 405 So. Dearborn Street, Chicago, Ill., that has a displacement of 90 cubic feet of air per minute, is regularly mounted on steel truck, and is described in a catalog which the company will be glad to send on request.

**A COMBINATION TOOL HEATER AND MELTING KETTLE**
A combination tool heater and melting kettle, Type S, that combines in one unit an oil-burning tool heater with a capacity for fifteen paving tools, such as tampers, smoothers, shovels, rakes, etc., and an asphalt cement heating kettle of 50 gallons capacity, and which will produce hot binder within ten minutes after starting the oil burners, is described in an illustrated catalog of the Aeroil Burner Co., Inc., Park Avenue and 13th Street, West New York, N. J.

**A NEW GASOLINE SHOVEL**
The Victor, a new gasoline shovel that will carry a 22- or 24-foot boom, a 15- or 16-foot handle and a 1½- or 1¾-yard dipper, and is adjustable for crane and dragline service, is described in literature which The Osgood Co., Marion, Ohio, will be glad to send interested contractors and engineers on request.

**PAVING AND CONSTRUCTION EQUIPMENT**
Bulletins of The Lakewood Engineering Co., Cleveland, Ohio, describe the following paving and construction equipment: finishing machines, subgraders, Carr road forms, graderooters, floatbridges, aluminum straight edges, batch box cars, steel batch boxes, and concrete mixers, steel towers, chuting equipment, mast chute plants, concrete carts, concrete buckets and cars, clamshell buckets, bin gates, and narrow gage track and V-dump cars.

**HOISTS FOR PROFITS**
Lidgerwood hoists that quarried the stone, set the stone and handled the materials for the additions to the Cathedral of St. John the Divine in New York, are completely described in literature of the Lidgerwood Manufacturing Co., Elizabeth, N. J.

**BOMB SHELL TORCHES**
Heavy steel, unbreakable bomb shell torches that cannot be tipped over, will not leak, require very little care, stay lit through rain, wind, snow or sleet, will not explode, and are never stolen, are described in a circular of the McCloskey Torch Co., Spitzer Building, Toledo, Ohio.

**A 3-SPEED TRANSMISSION HOIST**
A patent 3-speed transmission hoist with Asbestall frictions, is described in literature which The Mundy Sales Corp., 30 Church Street, New York, will be glad to send to interested contractors and engineers on request.

**TEN TIMES MORE LIGHT**
Ten times more light than an oil lantern, and at less cost, is one of the features of National carbide lanterns that are being used by contractors, tunnel workmen, street repair crews and others who want a dependable, strong, clear and penetrating light. Literature describing these lanterns will be sent by the National Carbide Sales Corp., 342 Madison Avenue, New York.

**PORTABLE ELEVATORS**
The very last word in hoisting machine for bricklayers, plasterers and builders, that can be erected by two men in two hours, is described in a catalog on the full line of O. K. hoists, portable elevators and air compressors of the O. K. Clutch & Machinery Co., Columbia, Pa.

**PROTECTION IN WIRE ROPE**
The Telfax tape marked factory certified feature of Williamsport wire rope is described in literature which the Williamsport Wire Rope Co., Williamsport, Pa., will be glad to send on request.

**STEEL DUMP BODIES**
The Wood line of all-steel dump bodies that has a correct type and capacity for every purpose and requirement, and serves the construction industry everywhere material is hauled and dumped, is described in a catalog of the Wood Hydraulic Hoist & Body Co., Detroit, Mich.

**STEEL SHEET PILING**
Before you buy or sell steel sheet piling, rails, portable track, cars, locomotive, cranes, tanks, hoists, draglines, pile hammers, oil engines, etc., write to Zelnicker, St. Louis, Mo., for Bargain Bulletins, that are available immediately on request.

**A NEW SMALL HANDSAW**
A new small electric handsaw with a cutting capacity of 2 inches, and equipped with a safety guard, that requires only one hand to operate and works easily in any position, is described in literature of the Wappat Gear Works, Inc., 7522-26 Meade Street, Pittsburgh, Pa.

**INDUSTRIAL LOCOMOTIVES**
Your haulage problems will be answered and your profits increased by the use of Whitcomb industrial locomotives, that are described in literature of the Geo. D. Whitcomb Co., Rochelle, Ill.

**FAST DIGGING BUCKETS**
Fast digging buckets that are faster because less cable is overhauled to give the required power due to the Williams combination of lever and block-and-tackle, that gives a straight line closing pull, entirely free from side loads, and that have great dependability and are "built to dig, and last while digging," are described in Bulletin DS-1 of the G. H. Williams Co., 609 Haybarger Lane, Erie, Pa.

**AN AUTO HEATER AND DISTRIBUTOR**
The Kinney auto heater and distributor that will properly heat and apply the heaviest asphalts and tars as well as the lighter grades of bituminous road material with equal efficiency and the least expenditure of time, labor and money, that is equipped with the Kinney positive pressure pump and the Kinney spraying nozzles and circulating and heating systems, and is self-loading from tank cars, is described in a booklet of the Kinney Manufacturing Co., Boston, Mass.

**A DEPENDABLE ROAD OR CONTRACTOR'S PLOW**
The Wiard "2-in-1" super-plow that is simple in construction, having only nine parts, besides braces and bolts, weighs 350 pounds with clevis, and that is for use with animal power, traction engine, road roller, dragline or other power, is described in a booklet of The Wiard Plow Co., Batavia, N. Y.

**LATE-MODEL, LOW-PRICED MIXERS**
A catalog and terms on the Kwik-Mix line of late model, low priced mixers will be sent interested contractors and engineers by the Kwik-Mix Concrete Mixer Co., Dept. 20, Port Washington, Wisc.

**A POWER DRAG SCRAPER**
A power drag scraper that is capable of hauling the toughest digging, and capable of conveying from 30 to 50 loads per hour to the hopper or pile, that ranges in size from ¼ to 6 cubic yards, meeting the capacity requirements of every excavating problem, is described in literature which Sauerman Bros., Inc., 464 So. Clinton Street, Chicago, Ill., will be glad to send interested parties on request.

**FULL PROTECTION WITH THIS TORCH**
Full protection is assured with the use of the self-righting torch of The Toledo Pressed Steel Co., 12th Street and Woodruff Avenue, Toledo, Ohio, that costs much less than scant or doubtful protection by other means, is unbreakable, reliable in any weather, is never stolen, uses cheaper fuel, and has many other desirable features.

**A TURBINE AIR CONCRETE SURFACER**
The No. 7-A turbine air concrete surfacer of The Tousley Tool Co., 1965 East 66th Street, Cleveland, Ohio, is a light weight, fast cutting and easily handled concrete surfacer that has plenty of power, and because the operator's hands are close to the work and the machine is easily handled, enables working in close corners and from a scaffold.

**AN AUTOMATIC TRACTOR SCRAPER**
An automatic tractor scraper that is especially good for short hauls, performs all operations by tractor power, is controlled by one man from the seat while the tractor is in motion, has nothing to oil or adjust, and can be operated backward and forward in shuttle fashion by adding the new "back-up-control," thereby eliminating all turning, is described in a circular of The Gustav Schaefer Wagon Co., 4130 Lorain Avenue, Cleveland, Ohio.

**GOOD ROADS AT REAL ECONOMY**
Warrenite-Bitulithic pavement that assures a contractor good road service at real economy is completely described in literature which Warren Brothers Co., Boston, Mass., will be glad to send to interested contractors and engineers.

**MORE AIR WITH THE SUPER-CHARGER**
The Thor Six air compressor with Rix super-charger that has both engine and compressor mounted on a common crankshaft, eliminating gears, clutches and couplings, resulting in a unit-type design that is responsible for the low upkeep cost of the Thor, is described in Bulletin 103 of the Independent Pneumatic Tool Co., 600 W. Jackson Boulevard, Chicago, Ill., which will be sent to interested contractors and engineers on request.

**CONCRETE MIXERS FOR DEPENDABILITY**
Lansing concrete mixers, that will give dependable service on the toughest jobs, are described in Catalog No. 19-C of the Lansing Co., Lansing, Mich.

**ALUMINUM RULES IN 10THS AND 100THS OF FEET**
Aluminum rules in 10ths and 100ths of feet, for civil engineers, surveyors, highway builders, tile layers, and others, that are accurate, light weight, durable, rust proof, and furnished with or without folding end hook, are described in literature of The Lufkin Rule Co., Saginaw, Mich.

**CLAMSHELL BUCKETS**
Complete information regarding Kiesler fast closing and fast opening clamshell buckets for contractors may be secured without obligation from the Jos. F. Kiesler Co., 936 W. Huron Street, Chicago, Ill.

# Capacity Counts— RUSSELL CAPACITY

**RUSSELL "42 GIANT" ELEVATING GRADER**
**Weight 12300 Pounds-42 Inch Belt**

Big things are expected of Russell and with unfailing energy and foresight we are continually aiming to match up with these expectations—always meeting in the fullest measure the ever increasing demand for greater and better equipment in every department of road building and road maintenance.

With the Russell "42 Giant" Elevating Grader we have exceeded all expectations. We have built far better than anyone thought possible. The "42 Giant" is easily the best Elevating Grader Russell ever built and this carries a big meaning with the thousands of expert, constructive American Road Builders.

Users report they can now load three wagons with the "42 Giant" against every two possible with other elevating graders—a real proof of capacity and economy.

*Write for special folder—sent free and postpaid*

Russell Grader Mfg. Co.
*Factory and General Offices* — Minneapolis

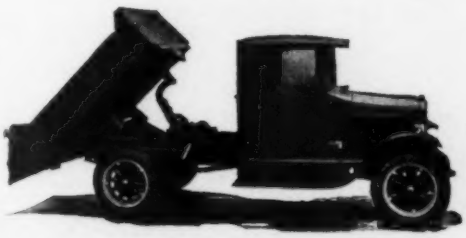
*Warehouses in all principal cities*

THE LAST WORD IN ROAD MACHINE CONSTRUCTION

# QUICK-EASY-SAFE OPERATION

**The Dump Body which is**

**ECONOMICAL**
**EFFICIENT**
**LONG-LASTING**



1. No stresses and strains on the chassis
2. Smooth-cradle like action
3. Less repairs—more productive hours per day

***HANDHOIST — GRAVITY — HYDRAULIC BODIES***

**THE GALION ALLSTEEL BODY CO.**
**Box 15,** **Galion, Ohio**

# *Even your Smaller Machines— are profit makers only when actually at work*

The time spent on the road between jobs, no matter what the size of the machine, is unprofitable. Highway Machinery Trailers reduce each of these profitless periods by hours. Highways are made in several types and in sizes ranging from 1½ tons to 75 tons.

***Write for Details***

**HIGHWAY TRAILER CO.**
Edgerton, Wisconsin, U. S. A.

### FOR EVERY DIRT MOVING PROBLEM

Monarch tractors that provide great drawbar horsepower, that offer scores of exclusive advantages in mechanical construction, made possible through the combined resources of Monarch-Allis-Chalmers engineers, that meet every dirt moving problem for maintenance work in road building, for cat wagon hauling, for every grader operation, are described in literature of the Monarch Tractors Corp., Springfield, Ill.

### ROAD BUILDING AND MAINTENANCE EQUIPMENT

"Good Roads" motor graders, screening and crushing plants, Junior and Senior motor road rollers, Champion oil distributors, and other road building and maintenance equipment that will aid you in completing the job on schedule and enable you to do an expert job, are described in literature which The Good Roads Machinery Co., Inc., Kennett Square, Pa., will be glad to send on request.

### A COMPLETE, MODERN, PROGRESSIVE LINE OF ROAD MACHINERY

The Galion line of road machinery that includes a machine of size and type to meet every need and requirement, that is being constantly improved and developed to progress with new methods of construction and maintenance of roads, is described completely and illustrated in a booklet of the Galion Iron Works & Manufacturing Co., Galion, Ohio.

### A COMPLETE LINE OF TRUCKS

Graham Brothers trucks that are all sizes have 4-wheel brakes, 6-cylinder power, 6-cylinder speed, flexibility and operating ease, with 4-speed transmission on the 1¼-, 1½- and 2½-ton sizes, and that are built for dependability and operating economy, are described in literature of the Dodge Brothers Division of the Chrysler Corp., Detroit, Mich.

### CURB AND ROAD FORMS, JOINT PLATES, ETC.

The Heltzel Steel Form & Iron Co., Warren, Ohio, will be glad to send to interested contractors information on road forms, curb forms, curb and gutter forms, joint plates, bins, etc., that are rigid units of contractors' equipment built for service and durability.

### A CONTRACTORS' PUMP

More gallons per day is the claim for the Humphryes contractors' pump, that is a high capacity pump for well-point drainage work, that will deliver a large volume of water hour after hour without a breakdown or stoppage, that has sturdy dependability, easy accessibility of vital parts, and other important features, and that is described in literature of The Humphryes Manufacturing Co., 203 East Fifth Street, Mansfield, Ohio.

### A CABLE CUTTER THAT SAVES TIME

The Starrett cable cutter that cuts any grade or size of cable up to 1 inch, and puts the seizing or whip on both ends of the cable to prevent fraying, is described in literature which the Morse-Starrett Products Co., 1916 Broadway, Oakland, Calif., successor to the W. D. Starrett Metal Cutting Products Co. of Alameda, Calif., will be glad to send on request.

### A PIPE CUTTER THAT SAVES COSTS

The Ellis pipe cutter with its six keen rotary cutting blades, which eats its way right through any pipe in double-quick time, that will save the cost of the pipe cutter on one job, and that will cut all kinds of pipe 4 to 12 inches in diameter, is described in a circular of the Ellis & Ford Manufacturing Co., 32 Piquette Avenue, Detroit, Mich.

### LIFE-TIME IDLERS

Stearns-Fairfield life-time idlers of extraordinary capacity for service with practically frictionless, dust-proof bearings requiring lubrication only once or twice a year, that have rollers that are interchangeable, adjustments that are permanent, are built to outwear and outlast the job no matter how heavy, how hard, or how big, are described completely in Descriptive Bulletin C-105 of The Fairfield Engineering Co., Marion, Ohio.

### A CONCRETE ROAD FINISHER

The Ord concrete road finisher with double sliding screed, that permits the use of the highest quality of concrete, with a resulting harder, firmer road that will stand the punishing wear of constant heavy traffic, is described in a new descriptive bulletin of A. W. French & Co., 8440 Lowe Avenue, Chicago, Ill., which will be sent contractors and engineers on request.

### A LIGHT DRAFT CRAWLER WAGON

A crawler wagon especially light in draft, that has creeper wheels with the same track surface and general dimensions as those used on wagons of 30 per cent greater gross weight, frame and drawbars designed to give an ample factor of safety with maximum heaped loads, and arch-type front drawbar allowing the tractor to undercut in turning, is described in literature of the Euclid Crane & Hoist Co., Euclid, Ohio.

### 4-WHEEL STEER, 4-WHEEL DRIVE TRACTORS

Atlas 4-wheel steer, 4-wheel drive tractors that plow their way without hesitation through mud, water, sand, and snow, uphill, across ditches, pulling stumps or other heavy loads, through all adverse conditions, and that have no complicated parts, are described in literature of the Atlas Engineering Co., Box "N," Clintonville, Wisc.

### STEEL STREET FORMS

Blaw-Knox steel street forms for curb, curb and gutter, integral curb, and sidewalks, are described in Bulletin No. 1024 of the Blaw-Knox Co., 667 Farmers Bank Building, Pittsburgh, Pa., which shows sixty illustrations that mean economy in your work, and which will be sent on request.

### SPEED PLUS ECONOMY IN TRACTORS

Whether it is road-building, road-maintenance, excavating, earth moving —no matter how heavy the job or how difficult the conditions, Cletrac crawler tractors will speed up your work, cut down your costs and give you profitable service. Their great drawbar power, sure traction, all-year utility, and other distinctive features are described in literature which The Cleveland Tractor Co., Cleveland, Ohio, will be glad to send on request.

### A ONE-MAN CONCRETE HIGHWAY SURFACER

A concrete highway surfacer for cutting down high spots, surface irregularities, uneven expansion joints and repaired patches, and producing a surface as even as a billiard table, that requires only one man for its operation, doing the work of ten men using other methods, eliminating the use of expensive equipment and large working crews, and that is equally effective on new or old roads, and surfaces pebble, furnace slag, broken limestone and traprock aggregates, is described in a circular of The Concrete Surfacing Machinery Co., Dept. F, 4669-71 Spring Grove Avenue, Cincinnati, Ohio.

### HOISTS THAT ARE INSURED AGAINST WEAR

Dake Type "20-LG" hoists that have Timken tapered roller bearings on the drum and intermediate shafts, that overcome wear from side-thrust and shock just as well as from friction and radial load, that have Alemite lubrication, Model "P-20" Continental 4-cylinder engine, Cumberland ground steel shafts and many other special features, are described in a bulletin of the Dake Engine Co., Grand Haven, Mich.

### ENGINES FOR DEPENDABLE POWER

Bulletins of the Le Roi Co., Milwaukee, Wisc., describing in detail and illustrating the Le Roi valve-in-head models in capacities ranging from 3 to 160 horsepower, that are made with all parts oversize, that are rigid in construction, give dependable service, better acceleration, smoother operation and increased fuel economy, may be obtained from the company on request.

### ENGINEERING DATA ON CLUTCHES

Engineering data on Twin Disc clutches for internal combustion engines, tractors, industrial, road building and material handling machinery, have been compiled in an illustrated booklet of the Twin Disc Clutch Co., Racine, Wisc., and will be sent by that company to interested engineers and officials.

### CENTRIFUGAL, SELF PRIMING PUMPS

Bulletin No. 29 of The La Bour Co., Chicago Heights, Ill., describes and illustrates centrifugal, self priming pumps that have moderate speed, large clearance, no valves, structural simplicity and positive ability to produce vacuum and exhaust air from an empty suction line, and is available on request, to interested contractors and engineers.

### A NEW SMALL TRACTOR

A small crawler tractor weighing approximately 4,000 pounds and known as the Caterpillar Ten which offers 10 horsepower at the drawbar and 14 horsepower on the belt, has been announced by the Caterpillar Tractor Co., San Leandro, Calif., for production and sale early in 1929. Complete information and prices may be secured on request from the manufacturer.

### ENGINES FROM 20 TO 100 HORSEPOWER

Specifications of Hercules engines and Hercules power units, that range from 20 to 100 horsepower, in capacities of 4 and 6 cylinders, are given, together with illustrations and descriptions, in a conclusive booklet of the Hercules Motors Corp., Canton, Ohio, which is available to interested parties on request.

### A NEW CONCRETE CART

The new No. 400 General concrete cart of the General Wheelbarrow Co., 3140 East 65th Street, Cleveland, Ohio, which has been designed to overcome the weaknesses heretofore encountered in this item of equipment, has an unbreakable hopper, sides flanged around the bottom and ends and welded, and angle steel reinforcing frame around the top that is unbreakable. It is described and illustrated in the General Wheelbarrow Handbook No. 107, which is available on request.

### PORTABLE AIR COMPRESSORS AND TOOLS

The 1928-29 catalog of Schramm, Inc., West Chester, Pa., describes the complete line of Schramm air compressors, including the new 360-cubic-foot unit as well as Schramm pneumatic rock drills and steels, asphalt and concrete breakers, riveting hammers, pneumatic spaders, surfacers, tampers and pile drivers.

### EXCAVATORS THAT ARE BUILT FOR SERVICE

Model 28, a ⅜-yard gasoline full-revolving, crawler-type, convertible shovel, clamshell, dragline, trench hoe and crane, is sturdy, of simple construction, and is light and small enough to be easily moved from one job to another at small cost and still heavy enough to be sturdy and rugged and able to stand the gaff of severe service, is described in an attractive booklet of The Hanson Clutch & Machinery Co., Tiffin, Ohio.

### A NEW FLOOD LIGHT ATTACHMENT

A flood light attachment of new design for use with small tanks of dissolved acetylene, the same as are used for truck and tractor lighting, that is a simple, strong, rigid and compact unit with 10-inch reflector and a new type of burner, is described in literature of the Prest-O-Lite Co., Inc., 30 East 42nd Street, New York.

### IMPROVED ACETYLENE GENERATORS

Three medium pressure-type acetylene generators for welding and cutting that have improvements over former models, are described in literature which the Oxweld Acetylene Co., 30 East 42nd Street, New York, will be glad to send interested contractors and engineers on request.

### NEW STYLE RIVETING HAMMERS

A new line of riveting hammers, manufactured in four sizes with 5-, 6-, 8- and 9-inch strokes, that are high in power, easy to operate, and low in air consumption, with several improved features of construction, is described in literature which the Ingersoll-Rand Co., 11 Broadway, New York, will be glad to send on request.

### AN EARTH BORING MACHINE

A combination of earth boring machine and pole setter that will traverse and operate in thick underbrush, will operate in ditches, knolls, hollows, embankments, etc., that reaches and digs, as well as sets the pole, and that will dig at any angle, is described in literature of the Highway Trailer Co., Edgerton, Wisc., that is available on request.

### DRY AND WATER-TYPE ROCK DRILLS

Bulletin 81-T of the Sullivan Machinery Co., 162 So. Michigan Avenue, Chicago, Ill., describes and illustrates in detail Sullivan "L-9" dry and water types of rotator rock drills, that offer the advantages of drilling speed, lightness, hole cleaning power, and air economy, for a wide variety of rock conditions, including nearly all but very hard or very soft ground.

### SPECIFICATIONS FOR HIGHWAY CONSTRUCTION AND MAINTENANCE

This is the title of a folder of general specifications to be modified to suit local conditions, published by The Barrett Co., 40 Rector Street, New York. It is a valuable booklet for contractors to have for consulting for road specifications.

### TO IMPROVE WORKABILITY OF CONCRETE

Celite, for improving the workability of concrete and keeping the cement and aggregates uniformly dispersed is described in detail in Bulletin 339 of the Celite Products Co., 11 Broadway, New York, which is available on request, to interested contractors and engineers.